

# **DETAIL STUDY OF MUNDRA - BATHINDA PIPELINE CONSTRUCTION**

A Thesis Submitted in Partial Fulfillment of the Requirements for the  
Degree of

**MASTER OF TECHNOLOGY  
IN  
PIPELINE ENGINEERING**

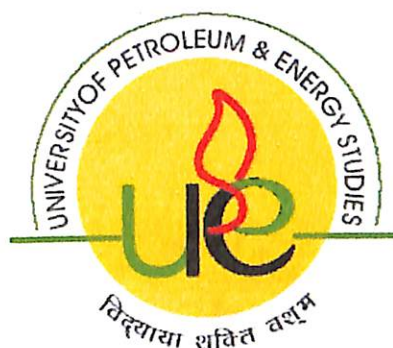
Under the Guidance of

**Dr. MUKESH SAXENA**

Submitted By

**KULESHWAR PRASAD NAYAK**

**(R150209021)**



**College of Engineering  
University of Petroleum & Energy Studies  
Dehradun  
May, 2011**

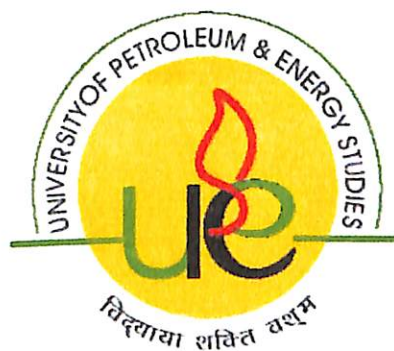
# DETAIL STUDY OF MUNDRA - BATHINDA PIPELINE CONSTRUCTION

A thesis submitted in partial fulfillment of the requirements for the Degree of  
**Master of Technology**  
(Pipeline Engineering)

By  
**Kuleshwar Prasad Nayak**

Under the guidance of  
**Dr. Mukesh Saxena.**

Approved  
  
Head of Department 9.5.11  
College of Engineering  
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College of Engineering  
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May, 2011



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POWER TRANSMISSION



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**TO WHOMSOEVER IT MAY CONCERN**

This is being certified that Mr. Kuleshwar Prasad Nayak S/o Sri Indal Ram Nayak, an M. Tech (Pipeline Engineering) student of University of Petroleum and Energy Studies, Dehradun has successfully completed his Summer Project in this Company. The duration of the project was one and half months i.e. 24.02.2011 to 02.04.2011 during which he has undergone all pipeline construction activities. We found him sincere, dedicated to assigned job and discipline. We wish him all success for his future endeavor.

**For Kalpataru Power Transmission Limited**

**For Kalpataru Power Transmission Ltd**

**Authorized Signatory**

**Authorised Signatory**

## CERTIFICATE

This is to certify that the work contained in this thesis titled "DETAIL STUDY OF MUNDRA-BATHINDA PIPELINE CONSTRUCTION" has been carried out by Kuleshwar Prasad Nayak under my supervision and has not been submitted elsewhere for a degree.



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**Kuleshwar Prasad Nayak**

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## **ABSTRACT**

THE CONCEPT OF proof testing engineering structures has its origins in antiquity. The precommissioning hydrostatic test (also known as the pre-service pressure test) has been an important part of the process of commissioning a newly-constructed pipeline for over 50 years, since its beginnings in the 1950s in the USA. The purpose of the hydro test is several-fold: to prove the leak tightness of the pipeline system at a pressure above the design pressure, as a strength (proof) test to identify (fail) defects and sub-standard pipe, and to prove a safety margin above the pipeline design pressure.

Failures during the hydro test are rare, but occasionally they do occur. The general consensus is that failures during the precommissioning hydrostatic test are now less common, and that failures due to defective line pipe (rather than due to leaking fittings) are rare. The historical data supports this consensus, but it also highlights that it is largely based on anecdotal evidence rather than data and analysis, because information on test failures is not now routinely gathered and published.

The results of the historical review demonstrate that understanding the causes and reasons for hydro test failures is important for learning from past mistakes, and also for identifying those cases where it may be possible to dispense with a precommissioning hydrotest. Reliable historical data on hydrotest failures is necessary to quantify trends over time, and to understand the causes of failure. The pipeline industry as a whole is not coherently recording this data: it should be.

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## NOMENCLATURE

|      |                                           |
|------|-------------------------------------------|
| KPTL | - Kalpataru Power Transmission Ltd        |
| EIL  | - Engineers India Ltd                     |
| MBPL | - Mudra-Bhatinda Pipeline                 |
| HMEL | -Hindustan Mittal Energy Ltd              |
| ROU  | - Right of Use                            |
| ROW  | -Right of Way                             |
| HDD  | -Horizontal Directional Drilling          |
| NDT  | -Non Destructive Testing                  |
| UT   | -Ultra Sonic Testing                      |
| DPT  | -Die-penetration Testing                  |
| WPS  | -Welding Procedure Specification          |
| API  | -American Petroleum Institute             |
| ASME | -American Society of Mechanical Engineers |
| PVC  | -Poly Vinyl Chloride                      |
| U/G  | -Under ground                             |

# **1. INTRODUCTION**

## **DEFINITION AND SCOPE:**

The term pipe is defined herein as a closed conduit, usually of circular cross section. It can be made of any appropriate material such as steel or plastic. The term pipeline refers to a long line of connected segments of pipe, with pumps, valves, control devices, and other equipment/facilities needed for operating the system. It is intended for transporting a fluid (liquid or gas), mixture of fluids, solids, fluid solid mixture, or capsules (freight-laden vessels or vehicles moved by fluids through a pipe). The term pipeline also implies a relatively large pipe spanning a long distance. Unless otherwise specified, the pipelines have a minimum diameter of 4 inches (102 mm) and a minimum length of 1 mi(1.6 km) . The largest and longest pipelines may have a diameter of over 10 ft (3.05 m) and a length of over 1000 miles (1609 Km).

## **HYDROTESTING**

Hydrostatic testing has long been used to determine and verify pipeline integrity. Several types of information can be obtained through this verification process.

However, it is essential to identify the limits of the test process and obtainable results. There are several types of flaws that can be detected by hydrostatic testing, such as:

- Existing flaws in the material,
- Stress Corrosion Cracking (SCC) and actual mechanical properties of the pipe,
- Active corrosion cells, and
- Localized hard spots that may cause failure in the presence of hydrogen.

There are some other flaws that cannot be detected by hydrostatic testing. For example, the sub-critical material flaws cannot be detected by hydro testing, but the test has profound impact on the post test behavior of these flaws.

Given that the test will play a significant role in the nondestructive evaluation of pipeline, it is important to determine the correct test pressure and then utilize that test pressure judiciously, to get the desired results.

## **2. HYDROTESTING PROCEDURE**

### **PRE-HYDROSTATIC TESTING**

The identified string shall be prepared for pre-testing.

The sections of pipeline for the crossings shall be pre-tested as a single string.

Welded pipe sections shall be pre-tested at a location near the crossing so as to reduce the further handling of section after testing.

The pre-tested pipes for using as pup pieces shall be marked in red - paint along the whole length of the pipe. While using section of the pre-tested pipe, the pipe number and heat number shall be transferred to every section of the pipe, which has been cut for use and recorded. Any pipe section which shall be found without a heat number or pipe number shall not be allowed to be a part of the pipe line

#### ***Preparation***

Pretesting skid will consist of the following equipment.

- A water tank for controlled filling into the manifold.
- Hydrotest pressure pump (motorized/Handpump)
- Calibrated pressure gauges for pressure indication at both ends (on test headers)
- Block valves for holding the water in the system and for venting
- Non-return valve at the pressurization inlet to hold the pressure while filling and pressurization is in progress.

The welded pipe section to be pre-tested shall be tested only after NDT clearance. No joint coating or primer application shall be done prior to hydrostatic pretest.

All welded joints shall be cleaned and exposed for visual inspection.

The test section shall be isolated.

Prior to water filling it shall be ensured that all test gauges and hoses are properly hooked up and that the test section is clean.

### ***Water filling***

Only clean water shall be used for the testing. The water from the source shall be pumped into the receiving tank. From the receiving tank, the water shall be pumped into the pre-testing module.

Drain shall be provided for draining out the water from the system.

### ***Pressurization***

#### **Test Pressure**

The hydrostatic test pressure for pre-testing shall be that pressure which will induce a hoop stress of 90% of the SMYS of the pipeline material in the section under test.

All test gauges shall be calibrated / certified and traceable to the Statutory Equipment Register.

Once the water has been filled into the test loop and the air vented out, pressure shall be applied by means of a pressurisation pump, suitable for the work.

Pressurisation shall be done at a uniform rate.

After attaining 30% of test pressure, a preliminary inspection shall be carried out of the holding the test for a while and upon satisfactory inspection, pressurisation shall continue. The pressure gauge at both ends shall provide the guidance to the pressure build up in the system.

A constant observation of the pressure building shall be maintained by reading of the gauge at regular interval of 30 minutes in the temperature / pressure recording log.

Once the test pressure is built up, observations shall be made to stabilize the pressure to the test pressure and also for temperature stabilization as format-F02

After temperature stabilization, the pressure shall be maintained in the pipeline for at least 04 hours.

The pipes under test shall be subjected to visual inspection for any leakage or deformation. Temperature and time shall be recorded.

### ***Acceptance Of Hydro Test***

Once there is no evidence of leakage after the holding time, the Hydro test shall be considered to have been accepted.

The system shall be depressurized.

The vents will be gently released till the gauge pressure comes to zero

The water in the entire test loop will be dispose off for swabbing and drying.

### **HYDROSTATIC TESTING**

A calculated / predetermined length of pipeline shall be selected for the hydrotest based on elevation, availability of water and location of stations. However the test section shall not exceed 50 Kms (it can be extended depending upon site condition only after approval of EIL). Graph showing the elevation of the complete test section shall be drawn prior to start of the test and enclosed in the hydrotest pack.

Hydro testing of mainline shall exclude valves at tap – off stations, terminals, pump stations, SV stations and scrapper station facilities.

The Equipment / Instruments to be used for performing the work shall include, but not limited to the following:

- Pigs for filling, cleaning and gauging: Cleaning pigs with spring loaded steel wire brushes.
- Two nos Air compressure of suitable capacity.
- Four cup batching pigs.
- Gauging pig with gauge plate.
- Fill Pumps with differential head 20% greater than the maximum required and a flow rate preferably between 400 M<sup>3</sup>/ h to 1000 M<sup>3</sup>/ h.
- If a single pump is used,a standby unit must be available.
- Variable speed Positive displacement pump equipped with digital stroke counter and capable of exceeding the maximum test pressure by at least 20 bar.
- Two positive displacement flow meters to measure the volume of water used for filling the line having a valid calibration certificate not older than one month.

- Portable tanks of sufficient size to provide continuous supply of water to the pump during pressurisation.
- Bourdon pressure gauges of suitable pressure range and accuracy with valid calibration certificate.
- Dead weight tester with an accuracy of 0.01 bar and Measuring in increments of 0.05 bar with a valid calibration certificate not older than one month at the time of first hydrostatic testing in the pipeline and if required it should be retested.
- Two 48 hours recording pressure gauges with charts and ink gauges tested with dead weight tester prior to use. Accuracy shall be 0.1% of the full scale value. This shall be installed at the test headers.
- Two temperature recorders with accuracy of +/- 1% of the scale range.
- Pressure recording charts.
- Thermocouples with valid calibration certificate.
- Two laboratory thermometer 0°C to 60°C range and accuracy  $\pm 0.1^\circ\text{C}$  to be used.
- Measuring cylinder to check quantity of water during air volume calculation.(dop line pressure by .05 bar)
- Injection facilities to inject additives in the test medium in the required proportion.
- Communication equipment suitable for continuous connection between the two ends.
- Temporary test headers fabricated in conformity with ASME section VIII, division 2 with particular reference to appendix 4 and 5 having sufficient length to accommodate the required number of pigs. The header shall also have provision for pig stopper.
- Piping and valve arrangement for launching and receiving of pigs independently.

### **Test Medium**

Filling and hydro testing shall be performed using soft non- aggressive water, free from sand and silt withdrawn from a suitable source in the pipeline route. The water shall be

filtered and shall not be contaminated. The water shall be tested in an approved lab for its non aggressiveness and suitability for using as the test medium. The test report shall be submitted to EIL for review. On the basis of water test report and manufacturers / laboratory's recommendations, the required quantity of corrosion inhibitor, oxygen scavenger, bactericides etc. shall be added to the test medium.

### **Test Pressure**

The pipeline shall be Hydrostatically tested to a minimum test shall be 1.25 times of the design pressure The maximum hydrostatic test pressure at lowest location in the pipeline during testing shall not exceed the pressure required to produce hoop stress equal to 90% of SMYS of pipe material based on the minimum wall thickness of the test section and corresponding test pressure at the highest point of the test section shall be subjected to the minimum test pressure as specified above. The test duration shall be 24 hrs.

### **Cleaning & Gauging of the Pipeline Test Section**

The cleaning operations shall be performed by propelling air driven pigs provided with spring loaded brushes and chisels. For this purposes temporary test headers shall be welded to the pipeline. The number of pig runs shall depend on the cleaning results and shall be determined by EIL/MBPL. Launching & receiving time of pigs and quantity and type of debris on completion of each run shall be recorded in the inspection report. The pig velocity shall be controlled by using the valve at receiving end to maintain the required backpressure of 0.5 to 2bar if required and pig velocity shall be approx. 2 to 3 km per hour.

After cleaning the pipeline by using air and acceptance there after by KPTL, EIL & MBPL a gauging pig fitted with gauge plate made of 10 mm thick commercial aluminium plate shall be propelled between the temporary test heads.

Tracking arrangement shall be provided in the first pig or incase any of the cleaning / gauging pig gets stuck inside the test section a second pig fitted with a tracking arrangement shall be propelled and it shall be tracked upto the point of fault.

The gauge plate is jointly signed by KPTL, EIL & MBPL representative during removal of gauge plate from the test section. The results of the gauge pig run shall be analysed to evaluate the internal status of the pipeline. A deformed, bent or severally nicked plate or damaged pig shall be evidence of gauging pig run failure and the same shall not be acceptable. In such cases KPTL shall repair and rectify the line and repeat the gauging pig run to the satisfaction of EIL.

After acceptance of gauging operation by EIL / MBPL, a photograph of the gauge plate is taken and attached with the gauging report.

The parameters of cleaning & gauging operations shall be recorded every 30 minutes.

### **Corrosion Inhibitor**

Corrosion inhibitor for hydrostatic testing from one of the EIL approved vendors shall be used. EIL/MBPL representative shall inspect the chemical container and take random samples prior to its use and shall get the sample tested in EIL nominated Govt./ PSU/ Other competent laboratories. Only those chemicals which have passed the above tests and approved by EIL/MBPL shall be used for hydro testing. The dosages for corrosion inhibitor shall be as per approved laboratory report and suitable for a period of 6 months.

### **Test Section Filling**

On acceptance of Gauging, the air pigging headers shall be cut and the temporary test heads already pretested at maximum pipeline test pressure shall be welded to the test section.

The pre-test report of the temporary test headers shall be submitted to EIL prior to start of welding the test header to the test section.

The filling end test header shall be pre loaded with three number of four cup batching pig.

The filling operation shall begin with pumping of uninhibited water equal to 10% of the volume of test section in front of the first pig with a flow rate preferably  $400 \text{ m}^3 / \text{hr.}$  to  $1000 \text{ m}^3 / \text{hr.}$

The first pig shall be launched by pumping about 1.5 km of uninhibited water. The second pig shall be launched by pumping inhibited water behind the 1<sup>st</sup> pig. The water column between these pigs shall act as a cushion to control the movement of the filling pig and hence minimise air entrapment.

The filling shall continue till the second pig reaches the other end of the test section and the pressure at the highest point rises to min one bar more than atmospheric pressure.

Required quantity of approved corrosion inhibitor shall be injected during the filling operation through any of the nozzles provided on the test header. The quantity of inhibitor shall be controlled by adjusting the flow rate of the dosing pump.

During the whole filling operation the valves at the receiving end test headers shall be throttled suitably to maintain adequate back pressure and thus control the pig movement.

The first two columns of water shall be drained out from the receiving end.

The different parameters during filling operation shall be recorded once every thirty minutes in the prescribed format enclosed in format no-F-8

Water temperature shall also be measured on the pump delivery by means of a recording thermometer throughout the filling stage.

Ground temperature shall be taken by measuring pipe temperature at the thermocouple prior to starting of the filling operation

Environmental temperature shall be recorded from the beginning of pressurization to the end of test by means of a recording thermometer.

### **Thermal Stabilization**

Once the test section has been completely filled and a minimum pressure of 1 bar has been achieved at the highest point, the thermal stabilization period shall be started.

Thermocouple for measuring the temperature of the pipe wall shall be installed on the pipeline to be tested as per the following:

- 1 thermocouple at about 500 M distance from the pumping head.
- 1 thermocouple at every 2500 M or maximum at every 5000 M depending on the terrain and nature of soil along the alignment of test section.
- 1 thermocouple at about 500 M distance from the terminal head.

The probe for measuring pipe temperature shall be installed by cutting a small portion (a little bigger than the probe tip) of the coating from the pipe, polishing the exposed portion and fixing the probe to the pipe with quick setting epoxy ensuring firm contact between the probe and pipe. The soil probe shall be poked into the earth adjacent to the pipe.

The temperature reading shall be taken at two hours interval with a calibrated digital temperature read out unit upto 1 decimal place and thermal stabilisation shall be considered to have been achieved when a difference not higher than 1°C is attained between the average values of the last two readings.

After completion and acceptance of hydro testing, thermocouples shall be removed and coating repaired as per approved coating repair procedure.

### **Pressurisation Operational Steps**

Mobilise high-pressure pump and test equipment at pressurisation area.

Install one pressure gauge in parallel with the dead weight tester.

As soon as the temperature stabilisation is achieved, the pressure shall be raised at a moderate and constant rate not exceeding 2-bar per minute.

Volume required to reach the test pressure shall be recorded periodically throughout the pressurisation as follows:

- Each 5 bar increments upto 80% of the test pressure as recorded by deadweight tester.
- Each 2 bar increments between 80% to 90% of the test pressure as recorded by deadweight tester.
- Each 0.2 bar increment between 90% of the test pressure to full test pressure as recorded by deadweight tester.

The pressurization shall be cycled with the sequence shown in the following pressure sequence.

Pressurise to 50% of test pressure, hold pressure for one hour, perform air volume test and drop pressure to static head.

Pressurise to 75% of test pressure, hold pressure for one hour, perform air volume test and drop pressure to static head.

Pressurise to test pressure, perform air volume test and raise pressure to the test pressure once again.

During the pressurization to each test pressure, two tests shall be carried out for the calculation of air volume in the pipeline under test.

In case, during the hold period indicated above, a decrease in pressure is observed, the above operation shall not be repeated more than twice, after which the line shall not be considered capable of test, until the cause for the lack of water tightness is eliminated.

On acceptance of the air volume test the pipeline pressure shall be raised to the pressure and pressure stabilisation period shall commence.

#### **Air Volume Calculation**

In order to check the presence of air in the pipeline two separate consecutive pressure lowerings of 0.5 bar by slowly bleeding water from the test section shall be carried out during all the pressurising cycling as mentioned above. The water drained during the second lowering shall be accurately measured ( $V_1$ ). This quantity measured shall be compared to the theoretical quantity ( $V_p$ ) corresponding to the pressure lowering. The

air volume shall be acceptable if  $V / V_p \leq 1.06$ . The observation shall be recorded in the air volume calculation format enclosed. If  $V / V_p$  exceeds 1.06, the hydrostatic test cannot go on and additional pig passages shall be performed to remove the air pockets.

#### **24 hour hold period**

The pressure shall be considered to be stabilised when no fluctuation is observed in the pipeline pressure as seen from the dead weight tester. On achieving pressure stabilisation, pressure pump connections shall be removed and the test section completely isolated and all connections at the test heads shall be checked for leakages. Pressure recorders shall then be started with the chart in real time orientation and the 24 hour pressure hold period shall start.

- a) Every one hour pressure measurement from dead weight tester
- b) Every two hours pipe and soil temperature from the thermocouples.

All data shall be recorded on appropriate forms.

Throughout the hold period, care shall be taken that the maximum test pressure should not exceed in lowest elevation of the pipeline section under test. Should it become necessary to de-pressurise, the volume of test medium bleed off shall be measured and recorded.

#### **Acceptance Criteria**

The hydrostatic test shall be considered as positive if pressure has kept a constant value throughout the test duration, except for change due to temperature effects.

The pressure change value as a function of temperature change shall be algebraically added to the pressure value as read on the meters. The pressure value thus adjusted shall be compared with the initial value and the test shall be considered as acceptable if difference is less than or equal to 0.3 bar.

On successful completion and acceptance of the hydrotest, the pipeline shall be slowly depressurised at a moderate and constant rate.

## **Leaks**

If during the pressurisation period or during the test periods any leaks are observed, these shall be eliminated.

If any leaks are suspected the section shall be initially visually inspected to check the eventual leaking point. If this check is negative, then the procedure described below shall be followed. No work shall be carried out to repair leaks until the pressure has been reduced to a safe pressure (i.e. static head plus 1 Kg/Cm<sup>2</sup>) and the water drained

## **Leak Detection**

To locate buried leaking pipe, the following procedure by elimination shall be followed:

1. To cut the section in an intermediate position
2. To insert two test heads
3. To reflood the sections
4. To pressurise the two sections
5. To determine the faulty section

This procedure shall be applied until the determination of the defect. As soon as the defect has been located and repaired, the test section shall be tested again.

If the test section fails to maintain the specified test pressure after isolation, KPTL shall determine by search the location of leakage for failure. All leaks and failure within the pipewall or weld seams shall be repaired by replacement of entire joint or joints in which leakage or failure occurs.

All cracks and splits resulting from failure shall be coated with an application of grease to preserve the characteristics of failure from corrosion. Joint of failed pipes shall be marked with paint, with a tag indicating failure details, date and location of failure and pressure at which failure occurred.

## **Pipeline Bulk Dewatering**

The dewatering shall be carried out by using four cup pigs and foam pigs driven by compressed air. The dewatering shall be done in such a way as to provide adequate control of pigs during dewatering. Pigs and equipment required for dewatering shall be approved by EIL in advance. Four cup pigs shall first be passed through the line to displace the water. Foam pigs shall then be passed in order to complete the line dewatering. The line shall be considered dewatered when a negligible amount of water is flushed out by the last foam pig.

Before disposal of the hydro test water, we shall add approved chemicals to neutralize the effects of inhibitor added during the hydro test. During dewatering care shall be taken to properly dispose the discharging water in order to avoid pollution, damages to fields under cultivation and / or existing structures and interference with the traffic.

Upon completion of the testing and dewatering operation, any provisional traps for pigs and all other temporary installation relating to the test shall be removed. Subsequently the individual sections of the line already tested shall be joined in accordance with the requirements of relevant specifications issued for the purpose.

The line pressure during dewatering operation shall be recorded every 30 minutes.

Once dewatering is over, the sectionalising valve and other valve assemblies shall be installed at the respective locations in accordance with the relevant procedures and specifications. All thermocouples installed in the pipeline shall be removed and damaged corrosion coating shall be repaired using approved procedure and materials.

Subsequent to dewatering, the SV installation followed by final golden tie-in between the tested sections shall be taken up.

### **3. COPUTATION DATA OF HYDROTESTING**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>KALPATARU POWER TRANSMISSION LIMITED</b>          |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mundra Bathinda Pipeline Project                     |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| Line Dia : 28" <span style="float: right;">REPORT NO. 3</span><br>DATE : 7.03.2011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| Spread : 1      From: CH 0.000      To: CH 161.350                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                      |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| Joint No.:      From: KM 35FT34A      To: KM 75FT51A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 15%;">O D ( mm )</th> <th colspan="2" style="width: 15%;">Wall Thk. (mm)</th> <th colspan="2" style="width: 15%;">I.D.(mm)</th> <th style="width: 10%;">Grade</th> <th style="width: 10%;">Length:</th> <th style="width: 15%;">40408.455</th> <th style="width: 10%;">mtr</th> </tr> <tr> <td rowspan="3" style="text-align: center; vertical-align: middle;">711.2</td> <td>Min.</td> <td style="text-align: center;">9.5</td> <td>Min.</td> <td style="text-align: center;">692.20</td> <td rowspan="3" style="text-align: center; vertical-align: middle;">API -5L<br/>GR.X-70</td> <td rowspan="3" style="text-align: center; vertical-align: middle;">Volume:</td> <td rowspan="3" style="text-align: center; vertical-align: middle;">15193.2711</td> <td rowspan="3" style="text-align: center; vertical-align: middle;">m<sup>3</sup></td> </tr> <tr> <td>Max.</td> <td style="text-align: center;">11.1</td> <td>Max.</td> <td style="text-align: center;">689.00</td> </tr> <tr> <td>Header</td> <td style="text-align: center;">14.3</td> <td></td> <td style="text-align: center;">682.60</td> </tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |      |            |        |                    | O D ( mm )                                  | Wall Thk. (mm) |                                                      | I.D.(mm) |                                      | Grade   | Length:                                              | 40408.455 | mtr                                              | 711.2   | Min.                                                   | 9.5     | Min.                                           | 692.20  | API -5L<br>GR.X-70                      | Volume: | 15193.2711                               | m <sup>3</sup> | Max.                                    | 11.1    | Max.                                            | 689.00  | Header                                    | 14.3    |                                         | 682.60  |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| O D ( mm )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Wall Thk. (mm)                                       |      | I.D.(mm)   |        | Grade              | Length:                                     | 40408.455      | mtr                                                  |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 711.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Min.                                                 | 9.5  | Min.       | 692.20 | API -5L<br>GR.X-70 | Volume:                                     | 15193.2711     | m <sup>3</sup>                                       |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Max.                                                 | 11.1 | Max.       | 689.00 |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Header                                               | 14.3 |            | 682.60 |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| <table style="width: 100%;"> <tr> <td style="width: 60%;">1. TEST PLAN FOR HYDRO TEST ( Format - 01 )</td> <td style="width: 40%; text-align: right;">YES /NO</td> </tr> <tr> <td>2. MECHANICAL CLEARANCE CERTIFICATE ( Format - 0 2 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>3. SAFETY CHECK LIST ( Format - 03 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>4. INSPECTION REPORT FOR AIR CLEANING ( Format -04 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>5. INSPECTION REPORT FOR GAUGING ( Format - 05 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>6. INSPECTION REPORT FOR WATER FILLING ( Format - 06 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>7. THERMAL STABILIZATION REPORT ( Format -07 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>8. PRESSURIZATION REPORT ( Format -08 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>9. AIR VOLUME CALCULATION ( Format -09 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>10. 24 HOURS HOLD PERIOD ( Format -10 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>11. HYDROTEST CALCULATION REPORT ( Format -11 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>12. HYDROSTATIC EVALUATION ( Format -12 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>13. DEPRESSURISATION REPORT (Formay-13)</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>14. COATING REPAIR ( Format - 14 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>15. DEWATERING REPORT ( Format - 15 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>16. LIST OF INSTRUMENTS USED. ( Format -16 )</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>17. NDT REPORTS OF TEMPORARY HEADER JOINTS</td> <td style="text-align: right;">YES /NO</td> </tr> <tr> <td>18. PRE TEST REPORT OF TEST HEADERS</td> <td style="text-align: right;">YES /NO</td> </tr> </table> |                                                      |      |            |        |                    | 1. TEST PLAN FOR HYDRO TEST ( Format - 01 ) | YES /NO        | 2. MECHANICAL CLEARANCE CERTIFICATE ( Format - 0 2 ) | YES /NO  | 3. SAFETY CHECK LIST ( Format - 03 ) | YES /NO | 4. INSPECTION REPORT FOR AIR CLEANING ( Format -04 ) | YES /NO   | 5. INSPECTION REPORT FOR GAUGING ( Format - 05 ) | YES /NO | 6. INSPECTION REPORT FOR WATER FILLING ( Format - 06 ) | YES /NO | 7. THERMAL STABILIZATION REPORT ( Format -07 ) | YES /NO | 8. PRESSURIZATION REPORT ( Format -08 ) | YES /NO | 9. AIR VOLUME CALCULATION ( Format -09 ) | YES /NO        | 10. 24 HOURS HOLD PERIOD ( Format -10 ) | YES /NO | 11. HYDROTEST CALCULATION REPORT ( Format -11 ) | YES /NO | 12. HYDROSTATIC EVALUATION ( Format -12 ) | YES /NO | 13. DEPRESSURISATION REPORT (Formay-13) | YES /NO | 14. COATING REPAIR ( Format - 14 ) | YES /NO | 15. DEWATERING REPORT ( Format - 15 ) | YES /NO | 16. LIST OF INSTRUMENTS USED. ( Format -16 ) | YES /NO | 17. NDT REPORTS OF TEMPORARY HEADER JOINTS | YES /NO | 18. PRE TEST REPORT OF TEST HEADERS | YES /NO |
| 1. TEST PLAN FOR HYDRO TEST ( Format - 01 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 2. MECHANICAL CLEARANCE CERTIFICATE ( Format - 0 2 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 3. SAFETY CHECK LIST ( Format - 03 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 4. INSPECTION REPORT FOR AIR CLEANING ( Format -04 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 5. INSPECTION REPORT FOR GAUGING ( Format - 05 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 6. INSPECTION REPORT FOR WATER FILLING ( Format - 06 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 7. THERMAL STABILIZATION REPORT ( Format -07 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 8. PRESSURIZATION REPORT ( Format -08 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 9. AIR VOLUME CALCULATION ( Format -09 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 10. 24 HOURS HOLD PERIOD ( Format -10 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 11. HYDROTEST CALCULATION REPORT ( Format -11 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 12. HYDROSTATIC EVALUATION ( Format -12 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 13. DEPRESSURISATION REPORT (Formay-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 14. COATING REPAIR ( Format - 14 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 15. DEWATERING REPORT ( Format - 15 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 16. LIST OF INSTRUMENTS USED. ( Format -16 )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 17. NDT REPORTS OF TEMPORARY HEADER JOINTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| 18. PRE TEST REPORT OF TEST HEADERS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | YES /NO                                              |      |            |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| KPTL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |      | EIL / HMPL |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| Sign :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      |      | Sign :     |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| Name :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      |      | Name :     |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |
| Date :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      |      | Date :     |        |                    |                                             |                |                                                      |          |                                      |         |                                                      |           |                                                  |         |                                                        |         |                                                |         |                                         |         |                                          |                |                                         |         |                                                 |         |                                           |         |                                         |         |                                    |         |                                       |         |                                              |         |                                            |         |                                     |         |

|  |                                             |                                          |  |
|--|---------------------------------------------|------------------------------------------|--|
|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b> |                                          |  |
|  | CLIENT : HMPL                               | CONSULTANT : ENGINEERS INDIA LTD.        |  |
|  | <b>MECHANICAL CLEARANCE CERTIFICFATE</b>    |                                          |  |
|  | Mundra Bathinda Pipeline Project            |                                          |  |
|  |                                             | DOC.NO.: KPTL/HBPL/PL/029/ F-02, Rev: 0. |  |

|                    |                    |                  |
|--------------------|--------------------|------------------|
| Line Dia :28"      | Spread : 1         | REPORT NO:- 03   |
|                    |                    | DATE : 5/03/2011 |
| Section No. HT- 02 | From: Ch 0.000     | To: Ch 161.350   |
| Joint No.          | From : KM 35 FT34A | To: KM 75 FT51A  |

| O D (mm)     | Wall Thk. (mm) | I.D.(mm) | Grade          |                                                                                                                                               |
|--------------|----------------|----------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>711.2</b> | 9.5            | 692.2    | API-5L GR.X-70 | <b>Length : 40396.455 mtr</b><br><br>Volume : 15188.8779 M <sup>3</sup> (with out header)<br>Volume : 15193.2711 M <sup>3</sup> (with header) |
|              | 10.3           | 690.6    |                |                                                                                                                                               |
|              | 11.1           | 689.0    |                |                                                                                                                                               |
|              | 14.3           | 682.6    |                |                                                                                                                                               |

|                     |              |                                                          |
|---------------------|--------------|----------------------------------------------------------|
| Wall Thickness (mm) | Length (Mtr) | Number Of Welds : 3375                                   |
| 9.5                 | 29728.465    | Length of not back filled section : 36.000 MTR.(Approx.) |
| 10.3                | 10355.620    | CONSTRUCTION PERIOD :                                    |
| 11.1                | 312.370      |                                                          |
| 14.3 (Header)       | 12.000       |                                                          |
|                     | 40408.455    | Start Date : 10/03/2010                                  |
|                     |              | End Date : 05/03/2011                                    |

**THIS IS TO CERTIFY THAT ALL WELDS OF THE ABOVE TEST SECTION HAVE BEEN ACCEPTED AND THE PIPELINE SECTION HAS BEEN LAID AND BACKFILLED ACCORDING TO THE SPECIFICATIONS. ALL ACTIVITIES UPTO PART-B OF PIPE BOOK IS COMPLETED.**

REMARKS ( Exceptions if any ) :- NIL

|             |                   |
|-------------|-------------------|
| <b>KPTL</b> | <b>EIL / HMPL</b> |
| Sign :      | Sign :            |
| Name:       | Name :            |
| Date :      | Date :            |

|                                   | <b>KALPATARU POWER TRANSMISSION LIMITED</b> |                                   |                                   |                                   |   |                     |                     |     |                       |         |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|-----|-----------------------|---------|
|                                                                                                                    | CLIENT : HMPL                               |                                   | CONSULTANT : ENGINEERS INDIA LTD. |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    | <b>INSPECTION REPORT AIR CLEANING</b>       |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    | Mundra Bathinda Pipeline Project            |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    | Mundra Bathinda Pipeline Project            |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| Line Dia : 28"                                                                                                     |                                             | Spread : I                        |                                   | REPORT NO: 3                      |                                                                                                                                                                         |                     |                     |     |                       |         |
| Section No.: HT-02                                                                                                 |                                             | From: CH 0.000 To: CH 161.350     |                                   | SHEET: 1 OF 1                     |                                                                                                                                                                         |                     |                     |     |                       |         |
| Joint No.                                                                                                          |                                             | From: KM 35 FT34A To: KM 75 FT51A |                                   | DATE: 03.03.2011                  |                                                                                                                                                                         |                     |                     |     |                       |         |
| O D (mm)                                                                                                           | Wall Thk. (mm)                              | I.D.(mm)                          | Grade                             | LENGTH: 40396.455 mtrs            |                                                                                                                                                                         |                     |                     |     |                       |         |
| 711.2                                                                                                              | Min. : 9.5                                  | Min. : 689.0                      | API -5L<br>GR.X 70                | VOLUME: 15188.8779 m <sup>3</sup> |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    | Max : 11.1                                  | Max: 692.2                        |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| <b>Compressor</b> Location: KM 35 Make : ELGI Model : FAB 205375<br>Out Put : 1100 cfm Max. Pressure : 20 kg/ sqcm |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| <b>Pigging Direction</b> From: KM 35 FT34A To: KM 75 FT51A                                                         |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| Run No                                                                                                             | Pig Type                                    | Start                             |                                   | End                               |                                                                                                                                                                         | Avg. Vel.<br>Km/HR. | Pressure ( Kg/ Cm2) |     | Quantity<br>of Debris | REMARKS |
|                                                                                                                    |                                             | DATE                              | TIME                              | DATE                              | TIME                                                                                                                                                                    |                     | Min                 | Max |                       |         |
| 1                                                                                                                  | FOUR CUP<br>BATCHING<br>PIG WITH<br>BRUSH   | 3/2/2011                          | 19:30                             | 3/3/2011                          | 13:05                                                                                                                                                                   | 2.297               | 0.5                 | 2.5 | APPX. 5<br>kgs        |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
|                                                                                                                    |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| REMARKS :                                                                                                          |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| Acceptance of section cleaning : Yes / No YES                                                                      |                                             |                                   |                                   |                                   |                                                                                                                                                                         |                     |                     |     |                       |         |
| KPTL                                                                                                               |                                             |                                   |                                   |                                   |                                                                                                                                                                         | EIL / HMPL          |                     |     |                       |         |
| Sign :                                                                                                             |                                             |                                   |                                   |                                   |                                                                                                                                                                         | Sign :              |                     |     |                       |         |
| Name:                                                                                                              |                                             |                                   |                                   |                                   |                                                                                                                                                                         | Name :              |                     |     |                       |         |
| Date :                                                                                                             |                                             |                                   |                                   |                                   |                                                                                                                                                                         | Date :              |                     |     |                       |         |

|                                           |                                      |  |                                   |  |  |  |
|-------------------------------------------|--------------------------------------|--|-----------------------------------|--|--|--|
|                                           | KALPATARU POWER TRANSMISSION LIMITED |  |                                   |  |  |  |
|                                           | CLIENT : HMPL                        |  | CONSULTANT : ENGINEERS INDIA LTD. |  |  |  |
|                                           | INSPECTION REPORT GAUGING            |  |                                   |  |  |  |
|                                           | Mundra Bathinda Pipeline Project     |  |                                   |  |  |  |
| DOCUMENT NO: KPTLMBPL-PL-029-F-05-Rev-0.0 |                                      |  |                                   |  |  |  |

|                   |                                   |                 |
|-------------------|-----------------------------------|-----------------|
| Line Dia : 28"    | Spread : 1                        | REPORT NO: 3    |
| Section No. HT-02 | From: CH 0.000 To: CH 161.350     | SHEET : 1 OF 3  |
| Joint No.         | From: KM 35 FT34A To: KM 75 FT51A | DATE : 3/6/2011 |

| O D ( mm ) | Wall Thk. (mm) | I D ( mm )   | Grade   | Length : | 40396.455  | mtrs           |
|------------|----------------|--------------|---------|----------|------------|----------------|
| 711.2      | Min. : 9.5     | Min. : 689.0 | API -5L |          |            |                |
|            | Max. : 11.1    | Max. : 692.2 | GR.X 70 | VOLUME:  | 15188.8779 | m <sup>3</sup> |

Compressor                      Location: KM 35    Make : ELGI                      Model : FAB 205375

                                         Out Put : 1100 cfm    Max. Pressure : 20 kg/ sqcm

Pigging Direction                      From: KM 35 FT34A    To : KM 75 FT51A

| SL. No. | Gauge Plate |             |          | Start    |       | End      |       | Avg. Vel.<br>Km/HR. | Pressure ( Kg / Cm <sup>2</sup> ) |     | Remarks |
|---------|-------------|-------------|----------|----------|-------|----------|-------|---------------------|-----------------------------------|-----|---------|
|         | Dia ( mm )  | Thk. ( mm ) | Material | Date     | Time  | Date     | Time  |                     | MAX                               | MIN |         |
| 1       | 654.55      | 10          | AL       | 3/5/2011 | 20:30 | 3/6/2011 | 22:10 | 1.574               | 3.4                               | 0.2 |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |
|         |             |             |          |          |       |          |       |                     |                                   |     |         |

Enclosure : - The Photography of Gauge Plate After Run (Yes / No) : .....YES

Detail of Gauge Plate Damaged ( IF any ) : .....NO.....

Signature on the gauge plate ( Yes /No ) : .....YES.....

Acceptance of section Gauging ( Yes / No ) : .....ACCEPTED.....

|        |            |
|--------|------------|
| KPTL   | EIL / HMPL |
| Sign:  | Sign :     |
| Name:  | Name :     |
| Date : | Date :     |

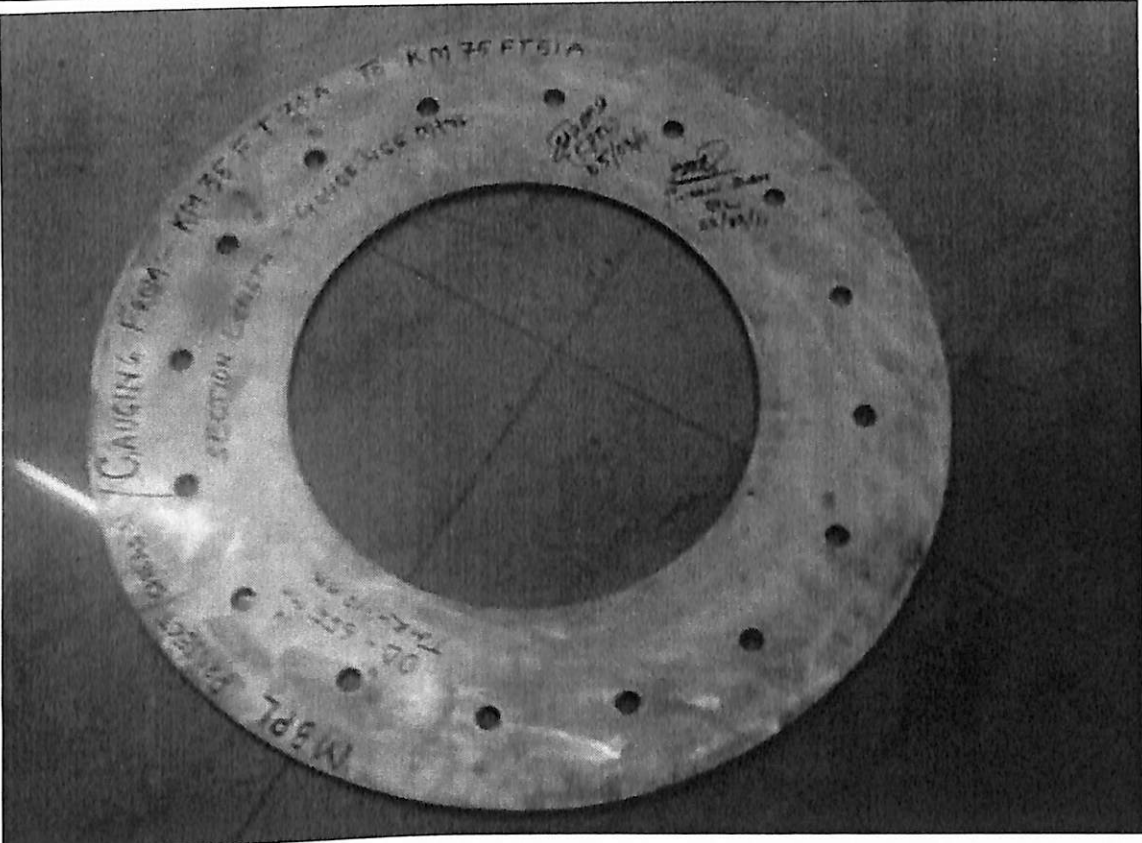
|                                                                                   |                                                      |  |                                                                                                                                                                         |
|-----------------------------------------------------------------------------------|------------------------------------------------------|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | KALPATARU POWER TRANSMISSION LIMITED                 |  |   |
|                                                                                   | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |  |                                                                                                                                                                         |
|                                                                                   | INSPECTION REPORT GAUGING                            |  |                                                                                                                                                                         |
|                                                                                   | Mundra Bathinda Pipeline Project                     |  |                                                                                                                                                                         |
| DOC NO: KPTL MBPL PL 029 F-05, Rev: 0                                             |                                                      |  |                                                                                                                                                                         |

|                   |                                   |                |                 |
|-------------------|-----------------------------------|----------------|-----------------|
| Line Dia : 28"    | Spread : 1                        | REPORT NO: 3   |                 |
| Section No. HT-02 | From: 0.000 To: 161.350           | SHEET : 2 OF 3 | DATE : 3/5/2011 |
| Joint No.         | From: KM 35 FT34A To: KM 75 FT51A |                |                 |

**PHOTOGRAPH OF GAUGE PLATE BEFORE RUN**



|                                                                          |  |
|--------------------------------------------------------------------------|--|
| Enclosure :- The Photography of Gauge Plate After Run (Yes / No) : ..... |  |
| Detail of Gauge Plate Damaged (if any) : .....                           |  |
| Signature on the gauge plate ( Yes /No ) : .....                         |  |
| Acceptance of section Gauging : (Yes / No ) : .....                      |  |
|                                                                          |  |
|                                                                          |  |
|                                                                          |  |

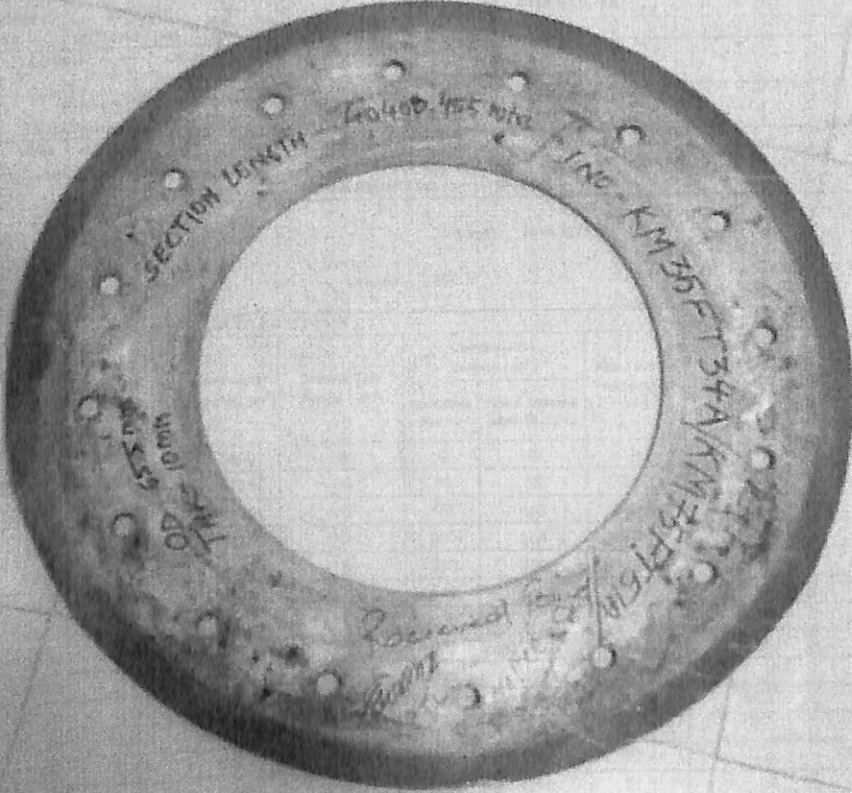
  

|        |            |
|--------|------------|
| KPTL   | EIL / HMPL |
| Sign:  | Sign :     |
| Name:  | Name :     |
| Date : | Date :     |

|                                                                                   |                                                      |  |                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------|------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | KALPATARU POWER TRANSMISSION LIMITED                 |  | <br><br>HMEL |
|                                                                                   | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |  |                                                                                                                                                                                    |
|                                                                                   | INSPECTION REPORT GAUGING                            |  |                                                                                                                                                                                    |
|                                                                                   | Mundra Bathinda Pipeline Project                     |  |                                                                                                                                                                                    |
| DOC NO: KPTLMBPL-PL-029-F-05, Rev. 0.                                             |                                                      |  |                                                                                                                                                                                    |

|                   |                                        |                 |  |
|-------------------|----------------------------------------|-----------------|--|
| Line Dia : 28"    | Spread : 1                             | REPORT NO: 3    |  |
|                   |                                        | SHEET : 3 OF 3  |  |
| Section No. HT-02 | From: 0.000      To: 161.350           | DATE : 3/6/2011 |  |
| Joint No.         | From: KM 35 FT34A      To: KM 75 FT51A |                 |  |

**PHOTOGRAPH OF GAUGE PLATE AFTER RUN**



|                                                                              |            |
|------------------------------------------------------------------------------|------------|
| Enclosure : - The Photography of Gauge Plate After Run (Yes / No) : .....yes |            |
| Detail of Gauge Plate Damaged (if any) : .....no.....                        |            |
| Signature on the gauge plate ( Yes /No ) : .....yes....                      |            |
| Acceptance of section Gauging : (Yes / No ) : .....yes.....                  |            |
|                                                                              |            |
|                                                                              |            |
|                                                                              |            |
| KPTL                                                                         | EIL / HMPL |
| Sign:                                                                        | Sign :     |
| Name:                                                                        | Name :     |
| Date :                                                                       | Date :     |

|                                                                                                                                                                                                                                                                                               | <b>KALPATARU POWER TRANSMISSION LIMITED</b>         |                                         |                                         |                                          |                                         |                                 |                                       |                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|-----------------------------------------|-----------------------------------------|------------------------------------------|-----------------------------------------|---------------------------------|---------------------------------------|------------------------------|
|                                                                                                                                                                                                                                                                                               | CLIENT: HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                                         |                                         |                                          |                                         |                                 |                                       |                              |
|                                                                                                                                                                                                                                                                                               | INSPECTION REPORT WATER FILLING                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
|                                                                                                                                                                                                                                                                                               | Mundra Bathinda Pipeline Project                    |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Line Dia : 28"      Spread : I      REPORT NO: 03<br>SHEET NO.: 1 OF 10<br>DATE : 15.03.11                                                                                                                                                                                                    |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Section No. HT-02      From: CH OO      To: CH 161.350<br>Joint No.      From: KM 35 FT34A      To: KM 75 FT51A                                                                                                                                                                               |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| O.D. (inch)                                                                                                                                                                                                                                                                                   |                                                     | Wall Thk. (mm)                          |                                         | I.D.(mm)                                 |                                         | Grade                           | Length 40408.455 mtr                  |                              |
| 28                                                                                                                                                                                                                                                                                            |                                                     | Min. : 9.5                              |                                         | Min. : 689.0                             |                                         | API -5L GR.<br>X 70             | Volume 15193.2711 m <sup>3</sup>      |                              |
|                                                                                                                                                                                                                                                                                               |                                                     | Max. : 11.1                             |                                         | Max. : 692.2                             |                                         |                                 |                                       |                              |
|                                                                                                                                                                                                                                                                                               |                                                     | Header : 14.3                           |                                         | Header : 682.6                           |                                         |                                 |                                       |                              |
| Test Medium : Water      Source : COT TANK & HT01      Location : COT<br>Corrosion Inhibition : Y/N      Type : REMIDOL 4000      Dosage : 600 PPM(COT) & 200PPM (HT01)<br>MTC No & Date : 25/11/10      Batch No. : R4000/251110/01<br>TPL Rpt No & Dt.: CIL/QC/10-11/09                     |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Fill Pump      Location : CH-35.407      Make : KIRLOSKAR<br>Out Put : 346 M <sup>3</sup> /hr      Max. Pressure : 25 Bar                                                                                                                                                                     |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Dosing Pump      Make : FLOW CONTROL      Model : FCP5030      Out Put : 350 Ltrs./ Hr<br>Max. Pressure : 50 BAR                                                                                                                                                                              |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Flow Meter.      Make : WOLTEX      FL-179 & 04.03.11<br>Calibration Certificate No & Date:      From KM35FT34A to KM75FT51A                                                                                                                                                                  |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Filling Direction :<br>Pig Sequence : I <sup>ST</sup> , II <sup>ND</sup> & III <sup>RD</sup> Volume: 1519.32711 M <sup>3</sup><br>Prefilling Length: 4.040 KM<br>1st Pig Type : FOUR CUP BATCHING<br>Between Pig 1 & 2 Length: 1.5 KM      Volume: 587 M <sup>3</sup><br>2nd Pig Type : BI-DI |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Pigging Direction FROM KM35 FT34A TO KM75 FT51A                                                                                                                                                                                                                                               |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| Date                                                                                                                                                                                                                                                                                          | Time                                                | Fill pressure<br>( Kg/Cm <sup>2</sup> ) | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume This<br>Period ( M <sup>3</sup> ) | Cumulative<br>Volume ( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>( -c ) | REMARKS                      |
|                                                                                                                                                                                                                                                                                               |                                                     |                                         |                                         |                                          | Including<br>Pre fill                   | Filled Volume<br>after Sec. Pig |                                       |                              |
| 08.03.11                                                                                                                                                                                                                                                                                      | 17:00                                               | 0.0                                     | 15850                                   | 0                                        | 0                                       | 0                               | 22.2                                  | Filling Start                |
|                                                                                                                                                                                                                                                                                               | 17:30                                               | 0.1                                     | 15945                                   | 95                                       | 95                                      | 95                              | 22.2                                  |                              |
|                                                                                                                                                                                                                                                                                               | 18:00                                               | 0.2                                     | 16005                                   | 60                                       | 155                                     | 155                             | 22.6                                  |                              |
|                                                                                                                                                                                                                                                                                               | 18:30                                               | 0.3                                     | 16110                                   | 105                                      | 260                                     | 260                             | 23.0                                  |                              |
|                                                                                                                                                                                                                                                                                               | 19:00                                               | 0.3                                     | 16230                                   | 120                                      | 380                                     | 380                             | 22.5                                  |                              |
|                                                                                                                                                                                                                                                                                               | 19:30                                               | 0.3                                     | 16360                                   | 130                                      | 510                                     | 510                             | 22.5                                  |                              |
|                                                                                                                                                                                                                                                                                               | 20:00                                               | 0.3                                     | 16470                                   | 110                                      | 620                                     | 620                             | 22.7                                  |                              |
|                                                                                                                                                                                                                                                                                               | 20:30                                               | 0.3                                     | 16552                                   | 82                                       | 702                                     | 702                             | 22.9                                  |                              |
|                                                                                                                                                                                                                                                                                               | 21:00                                               | 0.3                                     | 16648                                   | 96                                       | 798                                     | 798                             | 23.0                                  |                              |
|                                                                                                                                                                                                                                                                                               | 21:30                                               | 0.3                                     | 16749                                   | 101                                      | 899                                     | 899                             | 22.6                                  |                              |
|                                                                                                                                                                                                                                                                                               | 22:00                                               | 0.3                                     | 16850                                   | 101                                      | 1000                                    | 1000                            | 22.5                                  |                              |
|                                                                                                                                                                                                                                                                                               | 22:30                                               | 0.3                                     | 16951                                   | 101                                      | 1101                                    | 1101                            | 22.4                                  |                              |
|                                                                                                                                                                                                                                                                                               | 23:00                                               | 0.3                                     | 17048                                   | 97                                       | 1198                                    | 1198                            | 22.1                                  |                              |
|                                                                                                                                                                                                                                                                                               | 23:30                                               | 0.3                                     | 17148                                   | 100                                      | 1298                                    | 1298                            | 21.8                                  |                              |
| 09/03/11                                                                                                                                                                                                                                                                                      | 0:00                                                | 0.3                                     | 17244                                   | 96                                       | 1394                                    | 1394                            | 21.7                                  |                              |
|                                                                                                                                                                                                                                                                                               | 0:30                                                | 0.8                                     | 17347                                   | 103                                      | 1497                                    | 1497                            | 21.4                                  |                              |
|                                                                                                                                                                                                                                                                                               | 1:00                                                | 1.2                                     | 17378                                   | 31                                       | 1528                                    | 1528                            | 21.4                                  |                              |
|                                                                                                                                                                                                                                                                                               | 1:00                                                | 1.2                                     | 17378                                   | 0                                        | 1528                                    | 0                               | 21.4                                  | 1 <sup>st</sup> Pig Launched |
|                                                                                                                                                                                                                                                                                               | 1:30                                                | 1.8                                     | 17408                                   | 30                                       | 1558                                    | 30                              | 21.3                                  |                              |
|                                                                                                                                                                                                                                                                                               | 2:00                                                | 2.3                                     | 17483                                   | 75                                       | 1633                                    | 105                             | 21.6                                  |                              |
|                                                                                                                                                                                                                                                                                               | 2:30                                                | 2.3                                     | 17535                                   | 52                                       | 1685                                    | 157                             | 21.6                                  |                              |
| Readings to be recorded hourly<br>Filled water temperature to be recorded continuously on Temperature Recorder .                                                                                                                                                                              |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| REMARKS :<br>Acceptance of section WATER FILLING : Yes/No      YES                                                                                                                                                                                                                            |                                                     |                                         |                                         |                                          |                                         |                                 |                                       |                              |
| KPTL                                                                                                                                                                                                                                                                                          |                                                     |                                         |                                         |                                          | EIL / HMPL                              |                                 |                                       |                              |
| Sign :                                                                                                                                                                                                                                                                                        |                                                     |                                         |                                         |                                          | Sign :                                  |                                 |                                       |                              |
| Name :                                                                                                                                                                                                                                                                                        |                                                     |                                         |                                         |                                          | Name :                                  |                                 |                                       |                              |
| Date :                                                                                                                                                                                                                                                                                        |                                                     |                                         |                                         |                                          | Date :                                  |                                 |                                       |                              |

|  |                                                     |  |  |  |  |                                         |  |  |
|--|-----------------------------------------------------|--|--|--|--|-----------------------------------------|--|--|
|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b>         |  |  |  |  |                                         |  |  |
|  | CLIENT: HMPL      CONSULTANT : ENGINEERS INDIA LTD. |  |  |  |  |                                         |  |  |
|  | <b>INSPECTION REPORT WATER FILLING</b>              |  |  |  |  |                                         |  |  |
|  | Mundra Bathinda Pipeline Project                    |  |  |  |  |                                         |  |  |
|  |                                                     |  |  |  |  | DOC NO: KPTL HMPL PL 029 F-06<br>Rev. 0 |  |  |

|  |                                                      |
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|  | REPORT NO: 3<br>SHEET : 2 OF 10<br>DATE : 15.03.2011 |
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| Date | Time  | Fill pressure<br>( Kg/Cm <sup>2</sup> ) | Flow Meter<br>Reading<br>(m <sup>3</sup> ) | Volume This<br>Period<br>( M <sup>3</sup> ) | Cummulative Volume ( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>(-c ) | REMARKS                  |
|------|-------|-----------------------------------------|--------------------------------------------|---------------------------------------------|---------------------------------------|---------------------------------|--------------------------------------|--------------------------|
|      |       |                                         |                                            |                                             | Including Pre<br>fill                 | Filled Volume<br>after Sec. Pig |                                      |                          |
|      | 3:00  | 2.5                                     | 17617                                      | 82                                          | 1767                                  | 239                             | 21.8                                 |                          |
|      | 3:30  | 3.0                                     | 17688                                      | 71                                          | 1838                                  | 310                             | 22.1                                 |                          |
|      | 4:00  | 3.5                                     | 17763                                      | 75                                          | 1913                                  | 385                             | 22.0                                 |                          |
|      | 4:30  | 3.2                                     | 17841                                      | 78                                          | 1991                                  | 463                             | 21.90                                |                          |
|      | 5:00  | 3.6                                     | 17914                                      | 73                                          | 2064                                  | 536                             | 21.9                                 |                          |
|      | 5:30  | 3.8                                     | 17990                                      | 76                                          | 2140                                  | 612                             | 21.9                                 |                          |
|      | 5:30  | 3.8                                     | 17990                                      | 0                                           | 2140                                  | 0                               | 21.9                                 | 2 nd Pigg Launched and   |
|      | 6:00  | 3.6                                     | 18039                                      | 49                                          | 2189                                  | 49                              | 21.7                                 | 210 ltr Remidol Added    |
|      | 6:30  | 3.8                                     | 18094                                      | 55                                          | 2244                                  | 104                             | 21.4                                 |                          |
|      | 7:00  | 4.1                                     | 18139                                      | 45                                          | 2289                                  | 149                             | 21.3                                 |                          |
|      | 7:30  | 4.2                                     | 18178                                      | 39                                          | 2328                                  | 188                             | 21.3                                 |                          |
|      | 8:00  | 4.2                                     | 18246                                      | 68                                          | 2396                                  | 256                             | 21.3                                 |                          |
|      | 8:30  | 4.2                                     | 18296                                      | 50                                          | 2446                                  | 306                             | 21.3                                 |                          |
|      | 9:00  | 4.3                                     | 18339                                      | 43                                          | 2489                                  | 349                             | 21.3                                 |                          |
|      | 9:30  | 4.3                                     | 18387                                      | 48                                          | 2537                                  | 397                             | 21.5                                 |                          |
|      | 10:00 | 4.3                                     | 18428                                      | 41                                          | 2578                                  | 438                             | 21.7                                 |                          |
|      | 10:30 | 4.4                                     | 18466                                      | 38                                          | 2616                                  | 476                             | 21.9                                 |                          |
|      | 11:00 | 4.4                                     | 18510                                      | 44                                          | 2660                                  | 520                             | 21.9                                 |                          |
|      | 11:30 | 4.5                                     | 18603                                      | 93                                          | 2753                                  | 613                             | 22.0                                 |                          |
|      | 12:00 | 4.5                                     | 18645                                      | 42                                          | 2795                                  | 655                             | 22.1                                 |                          |
|      | 12:30 | 4.8                                     | 18690                                      | 45                                          | 2840                                  | 700                             | 22.2                                 |                          |
|      | 13:00 | 4.8                                     | 18725                                      | 35                                          | 2875                                  | 735                             | 22.3                                 |                          |
|      | 13:30 | 4.9                                     | 18760                                      | 35                                          | 2910                                  | 770                             | 22.3                                 |                          |
|      | 14:00 | 4.9                                     | 18810                                      | 50                                          | 2960                                  | 820                             | 22.4                                 |                          |
|      | 14:30 | 5.1                                     | 18872                                      | 62                                          | 3022                                  | 882                             | 23.1                                 |                          |
|      | 15:00 | 5.2                                     | 18890                                      | 18                                          | 3040                                  | 900                             | 23.1                                 |                          |
|      | 15:30 | 5.3                                     | 18957                                      | 67                                          | 3107                                  | 967                             | 23.1                                 |                          |
|      | 16:00 | 5.5                                     | 18991                                      | 34                                          | 3141                                  | 1001                            | 23.1                                 |                          |
|      | 16:30 | 5.5                                     | 19029                                      | 38                                          | 3179                                  | 1039                            | 21.7                                 |                          |
|      | 17:00 | 5.5                                     | 19068                                      | 39                                          | 3218                                  | 1078                            | 21.5                                 | 210 ltr Remidol added    |
|      | 17:30 | 5.5                                     | 19105                                      | 37                                          | 3255                                  | 1115                            | 21.4                                 |                          |
|      | 18:00 | 5.6                                     | 19159                                      | 54                                          | 3309                                  | 1169                            | 21.3                                 |                          |
|      | 18:30 | 5.6                                     | 19176                                      | 17                                          | 3326                                  | 1186                            | 21.2                                 | Pump stop at 18:30 again |
|      | 20:00 | 5.4                                     | 19238                                      | 62                                          | 3388                                  | 1248                            | 21.1                                 | started at 19:30         |

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| KPTL   | EIL / HMPL |
| Sign : | Sign :     |
| Name : | Name :     |
| Date : | Date :     |

|                                                     | KALPATARU POWER TRANSMISSION LIMITED   |                                         |                                         |                                             |                                       |                                 |                                           |                        |
|-----------------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|---------------------------------------------|---------------------------------------|---------------------------------|-------------------------------------------|------------------------|
|                                                     | CLIENT: HMPL                           |                                         |                                         | CONSULTANT : ENGINEERS INDIA LTD.           |                                       |                                 |                                           |                        |
|                                                     | <b>INSPECTION REPORT WATER FILLING</b> |                                         |                                         |                                             |                                       |                                 |                                           |                        |
|                                                     | Mundra Bathinda Pipeline Project       |                                         |                                         |                                             |                                       |                                 |                                           |                        |
|                                                     |                                        |                                         |                                         |                                             |                                       |                                 | DOC.NO: KPTL/HMPL/PL029/ F-06,<br>Rev: 0, |                        |
| REPORT NO: 3<br>SHEET : 3 OF 10<br>DATE : 15.3.2011 |                                        |                                         |                                         |                                             |                                       |                                 |                                           |                        |
| Date & Time                                         |                                        | Fill pressure<br>( Kg/Cm <sup>2</sup> ) | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume This<br>Period<br>( M <sup>3</sup> ) | Cummulative Volume ( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>(-c )      | REMARKS                |
|                                                     |                                        |                                         |                                         |                                             | Including<br>Pre fill                 | Filled Volume<br>after Sec. Pig |                                           |                        |
|                                                     | 20:30                                  | 5.5                                     | 19264                                   | 26                                          | 3414                                  | 1274                            | 21.5                                      |                        |
|                                                     | 21:00                                  | 5.5                                     | 19329                                   | 65                                          | 3479                                  | 1339                            | 21.7                                      |                        |
|                                                     | 21:30                                  | 5.7                                     | 19351                                   | 22                                          | 3501                                  | 1361                            | 21.6                                      |                        |
|                                                     | 22:00                                  | 5.6                                     | 19391                                   | 40                                          | 3541                                  | 1401                            | 21.5                                      |                        |
|                                                     | 22:30                                  | 5.7                                     | 19419                                   | 28                                          | 3569                                  | 1429                            | 23.1                                      |                        |
|                                                     | 23:00                                  | 5.7                                     | 19444                                   | 25                                          | 3594                                  | 1454                            | 21.5                                      |                        |
|                                                     | 23:30                                  | 5.6                                     | 19488                                   | 44                                          | 3638                                  | 1498                            | 21.5                                      |                        |
| 10/03/11                                            | 0:00                                   | 5.7                                     | 19516                                   | 28                                          | 3666                                  | 1526                            | 21.4                                      |                        |
|                                                     | 0:30                                   | 5.8                                     | 19560                                   | 44                                          | 3710                                  | 1570                            | 21.6                                      |                        |
|                                                     | 1:00                                   | 5.8                                     | 19596                                   | 36                                          | 3746                                  | 1606                            | 21.4                                      |                        |
|                                                     | 1:30                                   | 5.8                                     | 19636                                   | 40                                          | 3786                                  | 1646                            | 21.4                                      |                        |
|                                                     | 2:00                                   | 5.8                                     | 19645                                   | 9                                           | 3795                                  | 1655                            | 21.4                                      |                        |
|                                                     | 2:30                                   | 5.5                                     | 19691                                   | 46                                          | 3841                                  | 1701                            | 21.3                                      |                        |
|                                                     | 3:00                                   | 5.6                                     | 19727                                   | 36                                          | 3877                                  | 1737                            | 21.4                                      |                        |
|                                                     | 3:30                                   | 5.6                                     | 19735                                   | 8                                           | 3885                                  | 1745                            | 20.8                                      |                        |
|                                                     | 4:00                                   | 5.6                                     | 19772                                   | 37                                          | 3922                                  | 1782                            | 21.4                                      |                        |
|                                                     | 4:30                                   | 5.5                                     | 19795                                   | 23                                          | 3945                                  | 1805                            | 21.8                                      |                        |
|                                                     | 5:00                                   | 5.5                                     | 19837                                   | 42                                          | 3987                                  | 1847                            | 21.5                                      |                        |
|                                                     | 5:30                                   | 5.6                                     | 19842                                   | 5                                           | 3992                                  | 1852                            | 25.0                                      |                        |
|                                                     | 6:00                                   | 6.0                                     | 19875                                   | 33                                          | 4025                                  | 1885                            | 22.2                                      |                        |
|                                                     | 6:30                                   | 6.0                                     | 19899                                   | 24                                          | 4049                                  | 1909                            | 21.4                                      |                        |
|                                                     | 7:00                                   | 6.2                                     | 19924                                   | 25                                          | 4074                                  | 1934                            | 21.5                                      |                        |
|                                                     | 7:30                                   | 6.1                                     | 19957                                   | 33                                          | 4107                                  | 1967                            | 21.6                                      |                        |
|                                                     | 8:00                                   | 6.3                                     | 19979                                   | 22                                          | 4129                                  | 1989                            | 22.4                                      |                        |
|                                                     | 8:30                                   | 6.4                                     | 20001                                   | 22                                          | 4151                                  | 2011                            | 21.8                                      |                        |
|                                                     | 9:00                                   | 6.4                                     | 20020                                   | 19                                          | 4170                                  | 2030                            | 21.8                                      |                        |
|                                                     | 9:30                                   | 6.5                                     | 20055                                   | 35                                          | 4205                                  | 2065                            | 22.0                                      |                        |
|                                                     | 10:00                                  | 6.5                                     | 20080                                   | 25                                          | 4230                                  | 2090                            | 22.2                                      | 210 ltrs remidol added |
|                                                     | 10:30                                  | 6.5                                     | 20105                                   | 25                                          | 4255                                  | 2115                            | 22.2                                      |                        |
|                                                     | 11:00                                  | 6.1                                     | 20130                                   | 25                                          | 4280                                  | 2140                            | 23.5                                      |                        |
|                                                     | 11:30                                  | 6.5                                     | 20150                                   | 20                                          | 4300                                  | 2160                            | 23.5                                      |                        |
|                                                     | 12:00                                  | 6.8                                     | 20170                                   | 20                                          | 4320                                  | 2180                            | 31.1                                      |                        |
| KPTL                                                |                                        |                                         |                                         |                                             | EIL / HMPL                            |                                 |                                           |                        |
| Sign :                                              |                                        |                                         |                                         |                                             | Sign :                                |                                 |                                           |                        |
| Name :                                              |                                        |                                         |                                         |                                             | Name :                                |                                 |                                           |                        |
| Date :                                              |                                        |                                         |                                         |                                             | Date :                                |                                 |                                           |                        |

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|----------------------------------------------------|------------------------------------------------|--|--|--|--|--|-----------|
|                                                    | <b>KALPATARU POWER TRANSMISSION LIMITED</b>    |  |  |  |  |  | <br>H MEL |
|                                                    | CLIENT: HMPL CONSULTANT : ENGINEERS INDIA LTD. |  |  |  |  |  |           |
|                                                    | <b>INSPECTION REPORT FOR WATER FILLING</b>     |  |  |  |  |  |           |
|                                                    | Mundra Bathinda Pipeline Project               |  |  |  |  |  |           |
| REPORT NO: 2<br>SHEET : 4 OF 10<br>DATE : 15.03.11 |                                                |  |  |  |  |  |           |

| Date & Time    | Fill pressure ( Kg/Cm <sup>2</sup> ) | Flow Meter Reading (m <sup>3</sup> ) | Volume This Period ( M <sup>3</sup> ) | Cumulative Volume ( M <sup>3</sup> ) |                              | Filled Water Temperature (°c ) | REMARKS                                   |
|----------------|--------------------------------------|--------------------------------------|---------------------------------------|--------------------------------------|------------------------------|--------------------------------|-------------------------------------------|
|                |                                      |                                      |                                       | Including Pre fill                   | Filled Volume after Sec. Pig |                                |                                           |
| 12:30          | 5.5                                  | 20190                                | 20                                    | 4340                                 | 2200                         | 22.90                          | Pump stop at 12:30 again started at 15:30 |
| 16:00          | 5.6                                  | 20210                                | 20                                    | 4360                                 | 2220                         | 28.70                          |                                           |
| 16:30          | 6.5                                  | 20246                                | 36                                    | 4396                                 | 2256                         | 23.00                          |                                           |
| 17:00          | 6.5                                  | 20288                                | 42                                    | 4438                                 | 2298                         | 23.00                          |                                           |
| 17:30          | 7.0                                  | 20314                                | 26                                    | 4464                                 | 2324                         | 22.10                          |                                           |
| 18:00          | 7.0                                  | 20355                                | 41                                    | 4505                                 | 2365                         | 22.10                          |                                           |
| 18:30          | 7.0                                  | 20390                                | 35                                    | 4540                                 | 2400                         | 22.70                          |                                           |
| 19:00          | 7.0                                  | 20447                                | 57                                    | 4597                                 | 2457                         | 22.30                          |                                           |
| 19:30          | 7.0                                  | 20486                                | 39                                    | 4636                                 | 2496                         | 21.80                          |                                           |
| 20:00          | 7.0                                  | 20510                                | 24                                    | 4660                                 | 2520                         | 22.20                          |                                           |
| 20:30          | 7.0                                  | 20568                                | 58                                    | 4718                                 | 2578                         | 22.20                          |                                           |
| 21:00          | 6.5                                  | 20612                                | 44                                    | 4762                                 | 2622                         | 22.50                          |                                           |
| 21:30          | 6.5                                  | 20658                                | 46                                    | 4808                                 | 2668                         | 22.40                          |                                           |
| 22:00          | 6.5                                  | 20705                                | 47                                    | 4855                                 | 2715                         | 22.40                          |                                           |
| 22:30          | 6.5                                  | 20740                                | 35                                    | 4890                                 | 2750                         | 22.30                          |                                           |
| 23:00          | 6.5                                  | 20769                                | 29                                    | 4919                                 | 2779                         | 22.30                          |                                           |
| 23:30          | 6.5                                  | 20827                                | 58                                    | 4977                                 | 2837                         | 22.20                          |                                           |
| 11/03/11 23:30 | 6.5                                  | 20867                                | 40                                    | 5017                                 | 2877                         | 22.20                          |                                           |
| 0:00           | 6.5                                  | 20890                                | 23                                    | 5040                                 | 2900                         | 22.60                          |                                           |
| 0:30           | 6.5                                  | 20938                                | 48                                    | 5088                                 | 2948                         | 22.40                          |                                           |
| 1:00           | 6.5                                  | 20983                                | 45                                    | 5133                                 | 2993                         | 22.30                          |                                           |
| 1:30           | 6.5                                  | 21024                                | 41                                    | 5174                                 | 3034                         | 22.30                          |                                           |
| 2:00           | 6.5                                  | 21065                                | 41                                    | 5215                                 | 3075                         | 22.20                          |                                           |
| 2:30           | 6.0                                  | 21104                                | 39                                    | 5254                                 | 3114                         | 22.30                          |                                           |
| 3:00           | 6.0                                  | 21139                                | 35                                    | 5289                                 | 3149                         | 22.10                          | 210 ltrs remidol added                    |
| 3:30           | 6.0                                  | 21168                                | 29                                    | 5318                                 | 3178                         | 22.30                          |                                           |
| 4:00           | 6.0                                  | 21211                                | 43                                    | 5361                                 | 3221                         | 22.10                          |                                           |
| 4:30           | 6.0                                  |                                      |                                       |                                      |                              |                                |                                           |

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| KPTL   | EIL / HMPL |
| Sign : | Sign :     |
| Name : | Name :     |
| Date : | Date :     |

|  |       | KALPATARU POWER TRANSMISSION LIMITED           |                                         |                                         |                                      |                                 | <br>DOC.NO: KPTL/MBPL/PL/029/ F-06, Rev: 0. |                        |
|-----------------------------------------------------------------------------------|-------|------------------------------------------------|-----------------------------------------|-----------------------------------------|--------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                                                   |       | CLIENT: HMPL CONSULTANT : ENGINEERS INDIA LTD. |                                         |                                         |                                      |                                 |                                                                                                                                |                        |
|                                                                                   |       | INSPECTION REPORT FOR WATER FILLING            |                                         |                                         |                                      |                                 |                                                                                                                                |                        |
|                                                                                   |       | Mundra Bathinda Pipeline Project               |                                         |                                         |                                      |                                 |                                                                                                                                |                        |
| REPORT NO: 2<br>SHEET : 5 of 10<br>DATE : 15.03.2011                              |       |                                                |                                         |                                         |                                      |                                 |                                                                                                                                |                        |
| Date & Time                                                                       |       | Fill pressure<br>(Kg/Cm <sup>2</sup> )         | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume This<br>Period (M <sup>3</sup> ) | Cumulative Volume ( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>(°c)                                                                                            | REMARKS                |
|                                                                                   |       |                                                |                                         |                                         | Including Pre<br>filling             | Filled Volume<br>after Sec. Pig |                                                                                                                                |                        |
|                                                                                   | 5:00  | 6.0                                            | 21239                                   | 28                                      | 5389                                 | 3249                            | 22.1                                                                                                                           |                        |
|                                                                                   | 5:30  | 6.0                                            | 21270                                   | 31                                      | 5420                                 | 3280                            | 22.0                                                                                                                           |                        |
|                                                                                   | 6:00  | 5.0                                            | 21315                                   | 45                                      | 5465                                 | 3325                            | 22.1                                                                                                                           |                        |
|                                                                                   | 6:30  | 5.0                                            | 21339                                   | 24                                      | 5489                                 | 3349                            | 21.0                                                                                                                           |                        |
|                                                                                   | 7:00  | 5.0                                            | 21394                                   | 55                                      | 5544                                 | 3404                            | 21.9                                                                                                                           |                        |
|                                                                                   | 7:30  | 4.0                                            | 21426                                   | 32                                      | 5576                                 | 3436                            | 21.9                                                                                                                           |                        |
|                                                                                   | 8:00  | 4.0                                            | 21450                                   | 24                                      | 5600                                 | 3460                            | 21.9                                                                                                                           |                        |
|                                                                                   | 8:30  | 4.0                                            | 21494                                   | 44                                      | 5644                                 | 3504                            | 21.9                                                                                                                           |                        |
|                                                                                   | 9:00  | 4.0                                            | 21534                                   | 40                                      | 5684                                 | 3544                            | 22.2                                                                                                                           |                        |
|                                                                                   | 9:30  | 4.0                                            | 21570                                   | 36                                      | 5720                                 | 3580                            | 22.2                                                                                                                           |                        |
|                                                                                   | 10:00 | 4.0                                            | 21585                                   | 15                                      | 5735                                 | 3595                            | 22.6                                                                                                                           |                        |
|                                                                                   | 10:30 | 4.0                                            | 21631                                   | 46                                      | 5781                                 | 3641                            | 22.4                                                                                                                           |                        |
|                                                                                   | 11:00 | 4.0                                            | 21661                                   | 30                                      | 5811                                 | 3671                            | 22.7                                                                                                                           |                        |
|                                                                                   | 11:30 | 4.0                                            | 21703                                   | 42                                      | 5853                                 | 3713                            | 22.4                                                                                                                           |                        |
|                                                                                   | 12:00 | 4.0                                            | 21740                                   | 37                                      | 5890                                 | 3750                            | 22.4                                                                                                                           |                        |
|                                                                                   | 13:00 | 4.0                                            | 21793                                   | 53                                      | 5943                                 | 3803                            | 22.4                                                                                                                           |                        |
|                                                                                   | 13:30 | 4.0                                            | 21823                                   | 30                                      | 5973                                 | 3833                            | 22.5                                                                                                                           |                        |
|                                                                                   | 14:00 | 4.1                                            | 21853                                   | 30                                      | 6003                                 | 3863                            | 22.5                                                                                                                           |                        |
|                                                                                   | 14:30 | 3.8                                            | 21878                                   | 25                                      | 6028                                 | 3888                            | 22.4                                                                                                                           |                        |
|                                                                                   | 15:00 | 3.5                                            | 21908                                   | 30                                      | 6058                                 | 3918                            | 22.6                                                                                                                           |                        |
|                                                                                   | 15:30 | 3.6                                            | 21963                                   | 55                                      | 6113                                 | 3973                            | 22.8                                                                                                                           |                        |
|                                                                                   | 16:00 | 3.6                                            | 22035                                   | 72                                      | 6185                                 | 4045                            | 21.8                                                                                                                           |                        |
|                                                                                   | 16:30 | 3.7                                            | 22115                                   | 80                                      | 6265                                 | 4125                            | 21.9                                                                                                                           |                        |
|                                                                                   | 17:00 | 3.7                                            | 22191                                   | 76                                      | 6341                                 | 4201                            | 21.8                                                                                                                           | 210 ltrs remidol added |
|                                                                                   | 17:30 | 3.8                                            | 22231                                   | 40                                      | 6381                                 | 4241                            | 21.8                                                                                                                           |                        |
|                                                                                   | 18:00 | 4.1                                            | 22346                                   | 115                                     | 6496                                 | 4356                            | 21.9                                                                                                                           |                        |
|                                                                                   | 18:30 | 4.1                                            | 22419                                   | 73                                      | 6569                                 | 4429                            | 21.8                                                                                                                           |                        |
|                                                                                   | 19:00 | 4.1                                            | 22493                                   | 74                                      | 6643                                 | 4503                            | 21.6                                                                                                                           |                        |
|                                                                                   | 19:30 | 4.1                                            | 22575                                   | 82                                      | 6725                                 | 4585                            | 21.9                                                                                                                           |                        |
|                                                                                   | 20:00 | 4.1                                            | 22653                                   | 78                                      | 6803                                 | 4663                            | 22.1                                                                                                                           |                        |
|                                                                                   | 20:30 | 4.1                                            | 22723                                   | 70                                      | 6873                                 | 4733                            | 21.9                                                                                                                           |                        |
|                                                                                   | 21:00 | 4.1                                            | 22830                                   | 107                                     | 6980                                 | 4840                            | 21.9                                                                                                                           |                        |
|                                                                                   | 21:30 | 4.2                                            | 22871                                   | 41                                      | 7021                                 | 4881                            | 21.9                                                                                                                           |                        |

| KPTL   |  | EIL / HMPL |  |
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| Sign : |  | Sign :     |  |
| Name : |  | Name :     |  |
| Date : |  | Date :     |  |

|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b><br><b>CLIENT: HMPL CONSULTANT : ENGINEERS INDIA LTD.</b><br><b>INSPECTION REPORT FOR WATER FILLING</b><br><b>Mundra Bathinda Pipeline Project</b> |                                        |                                         |                                         |                                       |                                 | <br>DOC.NO: KPTL/MBPL/PL/029/ F-06,<br>Rev: 0. |                        |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|---------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                                                   |                                                                                                                                                                                               |                                        |                                         |                                         |                                       |                                 | <b>REPORT NO: 3</b><br><b>SHEET : 7 of 10</b><br><b>DATE : 15.3.2011</b>                                                          |                        |
|                                                                                   |                                                                                                                                                                                               |                                        |                                         |                                         |                                       |                                 |                                                                                                                                   |                        |
|                                                                                   |                                                                                                                                                                                               |                                        |                                         |                                         |                                       |                                 |                                                                                                                                   |                        |
| Date & Time                                                                       |                                                                                                                                                                                               | Fill pressure<br>(Kg/Cm <sup>2</sup> ) | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume This<br>Period (M <sup>3</sup> ) | Cummulative Volume ( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>(°c )                                                                                              | REMARKS                |
|                                                                                   |                                                                                                                                                                                               |                                        |                                         |                                         | Including Pre<br>filling              | Filled Volume<br>after Sec. Plg |                                                                                                                                   |                        |
|                                                                                   | 14:30                                                                                                                                                                                         | 4.0                                    | 25607                                   | 81                                      | 9757                                  | 7617                            | 22.4                                                                                                                              |                        |
|                                                                                   | 15:00                                                                                                                                                                                         | 4.0                                    | 25700                                   | 93                                      | 9850                                  | 7710                            | 22.7                                                                                                                              |                        |
|                                                                                   | 15:30                                                                                                                                                                                         | 4.0                                    | 25783                                   | 83                                      | 9933                                  | 7793                            | 22.7                                                                                                                              |                        |
|                                                                                   | 16:00                                                                                                                                                                                         | 4.5                                    | 25870                                   | 87                                      | 10020                                 | 7880                            | 22.7                                                                                                                              |                        |
|                                                                                   | 16:30                                                                                                                                                                                         | 4.5                                    | 25959                                   | 89                                      | 10109                                 | 7969                            | 22.8                                                                                                                              |                        |
|                                                                                   | 17:00                                                                                                                                                                                         | 4.5                                    | 26055                                   | 96                                      | 10205                                 | 8065                            | 22.9                                                                                                                              |                        |
|                                                                                   | 17:30                                                                                                                                                                                         | 4.5                                    | 26147                                   | 92                                      | 10297                                 | 8157                            | 23.0                                                                                                                              |                        |
|                                                                                   | 18:00                                                                                                                                                                                         | 4.5                                    | 26219                                   | 72                                      | 10369                                 | 8229                            | 23.0                                                                                                                              |                        |
|                                                                                   | 18:30                                                                                                                                                                                         | 4.5                                    | 26313                                   | 94                                      | 10463                                 | 8323                            | 23.0                                                                                                                              | 210 ltrs remidol added |
|                                                                                   | 19:00                                                                                                                                                                                         | 4.5                                    | 26411                                   | 98                                      | 10561                                 | 8421                            | 22.9                                                                                                                              |                        |
|                                                                                   | 19:30                                                                                                                                                                                         | 4.0                                    | 26502                                   | 91                                      | 10652                                 | 8512                            | 22.6                                                                                                                              |                        |
|                                                                                   | 20:00                                                                                                                                                                                         | 4.0                                    | 26572                                   | 70                                      | 10722                                 | 8582                            | 22.4                                                                                                                              |                        |
|                                                                                   | 20:30                                                                                                                                                                                         | 4.0                                    | 26673                                   | 101                                     | 10823                                 | 8683                            | 22.4                                                                                                                              |                        |
|                                                                                   | 21:00                                                                                                                                                                                         | 4.0                                    | 26777                                   | 104                                     | 10927                                 | 8787                            | 22.3                                                                                                                              |                        |
|                                                                                   | 21:30                                                                                                                                                                                         | 4.0                                    | 26872                                   | 95                                      | 11022                                 | 8882                            | 22.3                                                                                                                              |                        |
|                                                                                   | 22:00                                                                                                                                                                                         | 3.5                                    | 26955                                   | 83                                      | 11105                                 | 8965                            | 22.3                                                                                                                              |                        |
|                                                                                   | 22:30                                                                                                                                                                                         | 3.5                                    | 27035                                   | 80                                      | 11185                                 | 9045                            | 22.5                                                                                                                              |                        |
|                                                                                   | 23:00                                                                                                                                                                                         | 3.5                                    | 27144                                   | 109                                     | 11294                                 | 9154                            | 22.4                                                                                                                              |                        |
|                                                                                   | 23:30                                                                                                                                                                                         | 4.0                                    | 27240                                   | 96                                      | 11390                                 | 9250                            | 22.4                                                                                                                              |                        |
| 13/03/2011                                                                        | 0:00                                                                                                                                                                                          | 4.0                                    | 27320                                   | 80                                      | 11470                                 | 9330                            | 22.4                                                                                                                              |                        |
|                                                                                   | 0:30                                                                                                                                                                                          | 4.0                                    | 27425                                   | 105                                     | 11575                                 | 9435                            | 22.5                                                                                                                              | 210 ltrs remidol added |
|                                                                                   | 1:00                                                                                                                                                                                          | 4.5                                    | 27512                                   | 87                                      | 11662                                 | 9522                            | 22.5                                                                                                                              |                        |
|                                                                                   | 1:30                                                                                                                                                                                          | 4.5                                    | 27599                                   | 87                                      | 11749                                 | 9609                            | 22.5                                                                                                                              |                        |
|                                                                                   | 2:00                                                                                                                                                                                          | 4.0                                    | 27691                                   | 92                                      | 11841                                 | 9701                            | 22.6                                                                                                                              |                        |
|                                                                                   | 2:30                                                                                                                                                                                          | 4.0                                    | 27801                                   | 110                                     | 11951                                 | 9811                            | 22.6                                                                                                                              |                        |
|                                                                                   | 3:00                                                                                                                                                                                          | 4.0                                    | 27881                                   | 80                                      | 12031                                 | 9891                            | 22.6                                                                                                                              |                        |
|                                                                                   | 3:30                                                                                                                                                                                          | 4.0                                    | 27987                                   | 106                                     | 12137                                 | 9997                            | 22.5                                                                                                                              |                        |
|                                                                                   | 4:00                                                                                                                                                                                          | 4.0                                    | 28093                                   | 106                                     | 12243                                 | 10103                           | 22.5                                                                                                                              |                        |
|                                                                                   | 4:30                                                                                                                                                                                          | 4.0                                    | 28165                                   | 72                                      | 12315                                 | 10175                           | 22.5                                                                                                                              |                        |
|                                                                                   | 5:00                                                                                                                                                                                          | 4.0                                    | 28264                                   | 99                                      | 12414                                 | 10274                           | 22.4                                                                                                                              |                        |
|                                                                                   | 5:30                                                                                                                                                                                          | 4.0                                    | 28344                                   | 80                                      | 12494                                 | 10354                           | 22.4                                                                                                                              |                        |
|                                                                                   | 6:00                                                                                                                                                                                          | 4.0                                    | 28445                                   | 101                                     | 12595                                 | 10455                           | 22.5                                                                                                                              | 210 ltrs remidol added |
|                                                                                   | 6:30                                                                                                                                                                                          | 4.0                                    | 28549                                   | 104                                     | 12699                                 | 10559                           | 22.4                                                                                                                              |                        |
| KPTL                                                                              |                                                                                                                                                                                               |                                        |                                         |                                         | EIL / HMPL                            |                                 |                                                                                                                                   |                        |
| Sign :                                                                            |                                                                                                                                                                                               |                                        |                                         |                                         | Sign :                                |                                 |                                                                                                                                   |                        |
| Name :                                                                            |                                                                                                                                                                                               |                                        |                                         |                                         | Name :                                |                                 |                                                                                                                                   |                        |
| Date :                                                                            |                                                                                                                                                                                               |                                        |                                         |                                         | Date :                                |                                 |                                                                                                                                   |                        |

|                                                                                   |                                                |                                        |                                         |                                         |                                     |                                                     |                                                                                     |                        |
|-----------------------------------------------------------------------------------|------------------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|-------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------|------------------------|
|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b>    |                                        |                                         |                                         |                                     |                                                     |  |                        |
|                                                                                   | CLIENT: HMPL CONSULTANT : ENGINEERS INDIA LTD. |                                        |                                         |                                         |                                     |                                                     |                                                                                     |                        |
|                                                                                   | INSPECTION REPORT FOR WATER FILLING            |                                        |                                         |                                         |                                     |                                                     |                                                                                     |                        |
|                                                                                   | Mundra Bathinda Pipeline Project               |                                        |                                         |                                         |                                     |                                                     |                                                                                     |                        |
|                                                                                   |                                                |                                        |                                         |                                         |                                     | REPORT NO: 3<br>SHEET : 6 of 10<br>DATE : 15.3.2011 |                                                                                     |                        |
| Date & Time                                                                       |                                                | Fill pressure<br>(Kg/Cm <sup>2</sup> ) | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume This<br>Period (M <sup>3</sup> ) | Cumulative Volume (M <sup>3</sup> ) |                                                     | Filled Water<br>Temperature<br>(-c)                                                 | REMARKS                |
|                                                                                   |                                                |                                        |                                         |                                         | Including Pre<br>filling            | Filled Volume<br>after Sec. Pig                     |                                                                                     |                        |
|                                                                                   | 22:00                                          | 4.2                                    | 22946                                   | 75                                      | 7096                                | 4956                                                | 21.9                                                                                |                        |
|                                                                                   | 22:30                                          | 4.2                                    | 23032                                   | 86                                      | 7182                                | 5042                                                | 22.9                                                                                |                        |
|                                                                                   | 23:00                                          | 4.2                                    | 23112                                   | 80                                      | 7262                                | 5122                                                | 22.0                                                                                |                        |
|                                                                                   | 23:30                                          | 4.1                                    | 23188                                   | 76                                      | 7338                                | 5198                                                | 21.7                                                                                |                        |
| 12/03/11                                                                          | 0:00                                           | 4.1                                    | 23263                                   | 75                                      | 7413                                | 5273                                                | 21.7                                                                                | 210 ltrs remidol added |
|                                                                                   | 0:30                                           | 4.3                                    | 23339                                   | 76                                      | 7489                                | 5349                                                | 22.0                                                                                |                        |
|                                                                                   | 1:00                                           | 4.3                                    | 23421                                   | 82                                      | 7571                                | 5431                                                | 21.8                                                                                |                        |
|                                                                                   | 1:30                                           | 4.3                                    | 23501                                   | 80                                      | 7651                                | 5511                                                | 21.8                                                                                |                        |
|                                                                                   | 2:00                                           | 4.3                                    | 23578                                   | 77                                      | 7728                                | 5588                                                | 22.1                                                                                |                        |
|                                                                                   | 2:30                                           | 4.3                                    | 23678                                   | 100                                     | 7828                                | 5688                                                | 22.2                                                                                |                        |
|                                                                                   | 3:00                                           | 4.3                                    | 23749                                   | 71                                      | 7899                                | 5759                                                | 21.8                                                                                |                        |
|                                                                                   | 3:30                                           | 4.3                                    | 23819                                   | 70                                      | 7969                                | 5829                                                | 21.6                                                                                |                        |
|                                                                                   | 4:00                                           | 4.3                                    | 23900                                   | 81                                      | 8050                                | 5910                                                | 22.2                                                                                |                        |
|                                                                                   | 4:30                                           | 4.3                                    | 23966                                   | 66                                      | 8116                                | 5976                                                | 21.6                                                                                |                        |
|                                                                                   | 5:00                                           | 4.3                                    | 24107                                   | 141                                     | 8257                                | 6117                                                | 22.1                                                                                |                        |
|                                                                                   | 5:30                                           | 4.3                                    | 24130                                   | 23                                      | 8280                                | 6140                                                | 22.1                                                                                |                        |
|                                                                                   | 6:00                                           | 4.3                                    | 24209                                   | 79                                      | 8359                                | 6219                                                | 21.6                                                                                |                        |
|                                                                                   | 6:30                                           | 4.1                                    | 24288                                   | 79                                      | 8438                                | 6298                                                | 22.0                                                                                |                        |
|                                                                                   | 7:00                                           | 4.1                                    | 24368                                   | 80                                      | 8518                                | 6378                                                | 22.0                                                                                | 210 ltrs remidol added |
|                                                                                   | 7:30                                           | 4.2                                    | 24428                                   | 60                                      | 8578                                | 6438                                                | 21.9                                                                                |                        |
|                                                                                   | 8:00                                           | 4.4                                    | 24538                                   | 110                                     | 8688                                | 6548                                                | 21.9                                                                                |                        |
|                                                                                   | 8:30                                           | 4.4                                    | 24628                                   | 90                                      | 8778                                | 6638                                                | 21.9                                                                                |                        |
|                                                                                   | 9:00                                           | 4.5                                    | 24715                                   | 87                                      | 8865                                | 6725                                                | 21.9                                                                                |                        |
|                                                                                   | 9:30                                           | 4.5                                    | 24795                                   | 80                                      | 8945                                | 6805                                                | 22.1                                                                                |                        |
|                                                                                   | 10:00                                          | 4.5                                    | 24875                                   | 80                                      | 9025                                | 6885                                                | 22.2                                                                                |                        |
|                                                                                   | 10:30                                          | 4.5                                    | 24955                                   | 80                                      | 9105                                | 6965                                                | 22.3                                                                                |                        |
|                                                                                   | 11:00                                          | 4.5                                    | 25021                                   | 66                                      | 9171                                | 7031                                                | 22.5                                                                                |                        |
|                                                                                   | 11:30                                          | 4.5                                    | 25106                                   | 85                                      | 9256                                | 7116                                                | 22.0                                                                                |                        |
|                                                                                   | 12:00                                          | 4.5                                    | 25196                                   | 90                                      | 9346                                | 7206                                                | 21.9                                                                                |                        |
|                                                                                   | 12:30                                          | 4.5                                    | 25273                                   | 77                                      | 9423                                | 7283                                                | 22.4                                                                                | 210 ltrs remidol added |
|                                                                                   | 13:00                                          | 4.5                                    | 25358                                   | 85                                      | 9508                                | 7368                                                | 22.3                                                                                |                        |
|                                                                                   | 13:30                                          | 4.0                                    | 25450                                   | 92                                      | 9600                                | 7460                                                | 22.1                                                                                |                        |
|                                                                                   | 14:00                                          | 4.0                                    | 25526                                   | 76                                      | 9676                                | 7536                                                | 22.3                                                                                |                        |
| KPTL                                                                              |                                                |                                        |                                         |                                         | EIL / HMPL                          |                                                     |                                                                                     |                        |
| Sign :                                                                            |                                                |                                        |                                         |                                         | Sign :                              |                                                     |                                                                                     |                        |
| Name :                                                                            |                                                |                                        |                                         |                                         | Name :                              |                                                     |                                                                                     |                        |
| Date :                                                                            |                                                |                                        |                                         |                                         | Date :                              |                                                     |                                                                                     |                        |

|  | KALPATARU POWER TRANSMISSION LIMITED           |                                         |                                         |                                         |                                 |                                                      |  |                        |
|-----------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------------|-----------------------------------------|-----------------------------------------|---------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------|
|                                                                                   | CLIENT: HMPL CONSULTANT : ENGINEERS INDIA LTD. |                                         |                                         |                                         |                                 |                                                      |                                                                                     |                        |
|                                                                                   | INSPECTION REPORT FOR WATER FILLING            |                                         |                                         |                                         |                                 |                                                      |                                                                                     |                        |
|                                                                                   | Mundra Bathinda Pipeline Project               |                                         |                                         |                                         |                                 |                                                      |                                                                                     |                        |
|                                                                                   |                                                |                                         |                                         |                                         |                                 | REPORT NO: 3<br>SHEET : 10 of 10<br>DATE : 15.3.2011 |                                                                                     |                        |
| Date & Time                                                                       | Fill pressure<br>(Kg/Cm <sup>2</sup> )         | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume This<br>Period (M <sup>3</sup> ) | Cumulative Volume<br>( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>( c )                 | REMARKS                                                                             |                        |
|                                                                                   |                                                |                                         |                                         | Including Pre<br>filling                | Filled Volume<br>after Sec. Pig |                                                      |                                                                                     |                        |
|                                                                                   | 18:00                                          | 5.0                                     | 31790                                   | 41                                      | 15940                           | 13800                                                | 22.2                                                                                |                        |
|                                                                                   | 18:30                                          | 5.0                                     | 31821                                   | 31                                      | 15971                           | 13831                                                | 21.9                                                                                |                        |
|                                                                                   | 19:00                                          | 5.0                                     | 31842                                   | 21                                      | 15992                           | 13852                                                | 22.2                                                                                |                        |
|                                                                                   | 19:30                                          | 5.0                                     | 31885                                   | 43                                      | 16035                           | 13895                                                | 22.6                                                                                |                        |
|                                                                                   | 20:00                                          | 5.0                                     | 31911                                   | 26                                      | 16061                           | 13921                                                | 24.9                                                                                |                        |
|                                                                                   | 20:30                                          | 5.0                                     | 31927                                   | 16                                      | 16077                           | 13937                                                | 25.3                                                                                |                        |
| 15/03/2011                                                                        | 6:30                                           | 4.5                                     | 31983                                   | 56                                      | 16133                           | 13993                                                | 25.4                                                                                |                        |
|                                                                                   | 7:00                                           | 4.0                                     | 31989                                   | 6                                       | 16139                           | 13999                                                | 25.4                                                                                |                        |
|                                                                                   | 7:30                                           | 4.0                                     | 32060                                   | 71                                      | 16210                           | 14070                                                | 25.8                                                                                |                        |
|                                                                                   | 8:00                                           | 4.0                                     | 32152                                   | 92                                      | 16302                           | 14162                                                | 22.7                                                                                |                        |
|                                                                                   | 8:30                                           | 4.0                                     | 32202                                   | 50                                      | 16352                           | 14212                                                | 22.4                                                                                |                        |
|                                                                                   | 9:00                                           | 4.0                                     | 32292                                   | 90                                      | 16442                           | 14302                                                | 22.6                                                                                | 210 ltrs remidol added |
|                                                                                   | 9:30                                           | 4.0                                     | 32324                                   | 32                                      | 16474                           | 14334                                                | 22.9                                                                                |                        |
|                                                                                   | 10:00                                          | 4.0                                     | 32365                                   | 41                                      | 16515                           | 14375                                                | 23.4                                                                                |                        |
|                                                                                   | 10:30                                          | 4.0                                     | 32414                                   | 49                                      | 16564                           | 14424                                                | 23.5                                                                                |                        |
|                                                                                   | 11:00                                          | 4.0                                     | 32480                                   | 66                                      | 16630                           | 14490                                                | 23.4                                                                                | 1st Pigg received.     |
|                                                                                   | 11:30                                          | 4.4                                     | 32513                                   | 33                                      | 16663                           | 14523                                                | 22.9                                                                                |                        |
|                                                                                   | 12:00                                          | 4.4                                     | 32516                                   | 3                                       | 16666                           | 14526                                                | 23.0                                                                                |                        |
|                                                                                   | 12:30                                          | 4.6                                     | 32548                                   | 32                                      | 16698                           | 14558                                                | 23.4                                                                                |                        |
|                                                                                   | 13:00                                          | 4.4                                     | 32554                                   | 6                                       | 16704                           | 14564                                                | 25.4                                                                                |                        |
|                                                                                   | 13:30                                          | 4.3                                     | 32649                                   | 95                                      | 16799                           | 14659                                                | 26.4                                                                                |                        |
|                                                                                   | 14:00                                          | 5.0                                     | 32696                                   | 47                                      | 16846                           | 14706                                                | 23.4                                                                                |                        |
|                                                                                   | 14:30                                          | 4.5                                     | 32816                                   | 120                                     | 16966                           | 14826                                                | 23.1                                                                                |                        |
|                                                                                   | 15:00                                          | 4.4                                     | 32910                                   | 94                                      | 17060                           | 14920                                                | 23.3                                                                                | 210 ltrs remidol added |
|                                                                                   | 15:30                                          | 4.3                                     | 32984                                   | 74                                      | 17134                           | 14994                                                | 23.2                                                                                |                        |
|                                                                                   | 16:00                                          | 4.5                                     | 33032                                   | 48                                      | 17182                           | 15042                                                | 22.9                                                                                |                        |
|                                                                                   | 16:30                                          | 4.6                                     | 33133                                   | 101                                     | 17283                           | 15143                                                | 23.1                                                                                |                        |
|                                                                                   | 17:00                                          | 4.5                                     | 33273                                   | 140                                     | 17423                           | 15283                                                | 22.8                                                                                | 2 nd Pigg received.    |
|                                                                                   | 17:30                                          | 5.0                                     | 33414                                   | 141                                     | 17564                           | 15424                                                | 22.7                                                                                |                        |
|                                                                                   | 18:00                                          | 5.0                                     | 33546                                   | 132                                     | 17696                           | 15556                                                | 22.6                                                                                |                        |
|                                                                                   | 18:30                                          | 4.3                                     | 33628                                   | 82                                      | 17778                           | 15638                                                | 23.0                                                                                |                        |
|                                                                                   | 19:00                                          | 4.4                                     | 33711                                   | 83                                      | 17861                           | 15721                                                | 23.0                                                                                |                        |
|                                                                                   | 19:30                                          | 4.4                                     | 33788                                   | 77                                      | 17938                           | 15798                                                | 22.7                                                                                |                        |
|                                                                                   | 20:00                                          | 10.5                                    | 33901                                   | 113                                     | 18051                           | 15911                                                | 22.9                                                                                |                        |
|                                                                                   | 20:30                                          | 16                                      | 34002                                   | 101                                     | 18152                           | 16012                                                | 24                                                                                  |                        |
| KPTL                                                                              |                                                |                                         |                                         |                                         | EIL / HMPL                      |                                                      |                                                                                     |                        |
| Sign :                                                                            |                                                |                                         |                                         |                                         | Sign :                          |                                                      |                                                                                     |                        |
| Name :                                                                            |                                                |                                         |                                         |                                         | Name :                          |                                                      |                                                                                     |                        |
| Date :                                                                            |                                                |                                         |                                         |                                         | Date :                          |                                                      |                                                                                     |                        |

|                                                                                   |                                                   |  |  |  |  |  |                                                                                                                                                   |
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|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b>       |  |  |  |  |  | <br><small>DOC.NO: KPTL/MBPL/PL/029/<br/>F-06, Rev: 0.</small> |
|                                                                                   | CLIENT: HMPL    CONSULTANT : ENGINEERS INDIA LTD. |  |  |  |  |  |                                                                                                                                                   |
|                                                                                   | INSPECTION REPORT FOR WATER FILLING               |  |  |  |  |  |                                                                                                                                                   |
|                                                                                   | Mundra Bathinda Pipeline Project                  |  |  |  |  |  |                                                                                                                                                   |

|  |                                                                          |
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|  | <b>REPORT NO:</b> 3<br><b>SHEET :</b> 8 of 10<br><b>DATE :</b> 15.3.2011 |
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| Date & Time | Fill pressure<br>(Kg/Cm <sup>2</sup> ) | Flow Meter<br>Reading (m <sup>3</sup> ) | Volume<br>This<br>Period<br>(M <sup>3</sup> ) | Cummulative Volume ( M <sup>3</sup> ) |                                 | Filled Water<br>Temperature<br>( c ) | REMARKS |                                                              |
|-------------|----------------------------------------|-----------------------------------------|-----------------------------------------------|---------------------------------------|---------------------------------|--------------------------------------|---------|--------------------------------------------------------------|
|             |                                        |                                         |                                               | Including Pre<br>filling              | Filled Volume<br>after Sec. Pig |                                      |         |                                                              |
|             | 7:00                                   | 4.0                                     | 28637                                         | 88                                    | 12787                           | 10647                                | 22.4    |                                                              |
|             | 7:30                                   | 4.0                                     | 28734                                         | 97                                    | 12884                           | 10744                                | 22.4    |                                                              |
|             | 8:00                                   | 4.0                                     | 28825                                         | 91                                    | 12975                           | 10835                                | 22.4    |                                                              |
|             | 8:30                                   | 4.0                                     | 28931                                         | 106                                   | 13081                           | 10941                                | 22.5    |                                                              |
|             | 9:00                                   | 4.0                                     | 29016                                         | 85                                    | 13166                           | 11026                                | 22.5    |                                                              |
|             | 9:30                                   | 4.0                                     | 29121                                         | 105                                   | 13271                           | 11131                                | 22.5    |                                                              |
|             | 10:00                                  | 4.0                                     | 29201                                         | 80                                    | 13351                           | 11211                                | 22.5    |                                                              |
|             | 10:30                                  | 4.0                                     | 29243                                         | 42                                    | 13393                           | 11253                                | 23.1    |                                                              |
|             | 12:00                                  | 4.1                                     | 29325                                         | 82                                    | 13475                           | 11335                                | 22.9    |                                                              |
|             | 12:30                                  | 4.1                                     | 29424                                         | 99                                    | 13574                           | 11434                                | 22.7    |                                                              |
|             | 13:00                                  | 4.3                                     | 29492                                         | 68                                    | 13642                           | 11502                                | 22.6    | 210 ltrs remidol added                                       |
|             | 13:30                                  | 4.3                                     | 29570                                         | 78                                    | 13720                           | 11580                                | 22.9    |                                                              |
|             | 14:00                                  | 4.5                                     | 29623                                         | 53                                    | 13773                           | 11633                                | 22.7    |                                                              |
|             | 14:30                                  | 4.6                                     | 29683                                         | 60                                    | 13833                           | 11693                                | 22.9    |                                                              |
|             | 15:00                                  | 4.6                                     | 29747                                         | 64                                    | 13897                           | 11757                                | 22.6    |                                                              |
|             | 15:30                                  | 4.7                                     | 29810                                         | 63                                    | 13960                           | 11820                                | 22.7    |                                                              |
|             | 16:00                                  | 4.5                                     | 29885                                         | 75                                    | 14035                           | 11895                                | 22.7    |                                                              |
|             | 16:30                                  | 4.4                                     | 29924                                         | 39                                    | 14074                           | 11934                                | 22.6    |                                                              |
|             | 17:00                                  | 4.4                                     | 29963                                         | 39                                    | 14113                           | 11973                                | 22.5    |                                                              |
|             | 17:30                                  | 4.4                                     | 30022                                         | 59                                    | 14172                           | 12032                                | 22.6    | Pump stop at 17:30 o'clock<br>again started at 18:30 o'clock |
|             | 21:00                                  | 4.4                                     | 30079                                         | 57                                    | 14229                           | 12089                                | 22.1    |                                                              |
|             | 21:30                                  | 4.5                                     | 30113                                         | 34                                    | 14263                           | 12123                                | 22.5    |                                                              |
|             | 22:00                                  | 4.5                                     | 30162                                         | 49                                    | 14312                           | 12172                                | 22.0    |                                                              |
|             | 22:30                                  | 4.5                                     | 30215                                         | 53                                    | 14365                           | 12225                                | 22.4    |                                                              |
|             | 23:00                                  | 4.4                                     | 30261                                         | 46                                    | 14411                           | 12271                                | 22.1    |                                                              |
|             | 23:30                                  | 4.4                                     | 30301                                         | 40                                    | 14451                           | 12311                                | 22.0    |                                                              |
|             |                                        |                                         |                                               |                                       |                                 |                                      |         |                                                              |
| 14/03/2011  | 0:00                                   | 4.5                                     | 30355                                         | 54                                    | 14505                           | 12365                                | 21.9    |                                                              |
|             | 0:30                                   | 4.5                                     | 30390                                         | 35                                    | 14540                           | 12400                                | 22.0    |                                                              |
|             | 1:00                                   | 4.5                                     | 30438                                         | 48                                    | 14588                           | 12448                                | 22.0    |                                                              |
|             | 1:30                                   | 4.5                                     | 30470                                         | 32                                    | 14620                           | 12480                                | 22.1    |                                                              |
|             | 2:00                                   | 4.5                                     | 30498                                         | 28                                    | 14648                           | 12508                                | 22.1    |                                                              |

|             |                   |
|-------------|-------------------|
| <b>KPTL</b> | <b>EIL / HMPL</b> |
| Sign :      | Sign :            |
| Name :      | Name :            |
| Date :      | Date :            |

|                                                                                   |                                                |  |                                                                                                                                              |
|-----------------------------------------------------------------------------------|------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------|
|  | KALPATARU POWER TRANSMISSION LIMITED           |  | <br>H M E L<br>DOC.NO: KPTL/MBPL/PL/029/<br>F-06, Rev: 0. |
|                                                                                   | CLIENT: HMPL CONSULTANT : ENGINEERS INDIA LTD. |  |                                                                                                                                              |
|                                                                                   | INSPECTION REPORT FOR WATER FILLING            |  |                                                                                                                                              |
|                                                                                   | Mundra Bathinda Pipeline Project               |  |                                                                                                                                              |

REPORT NO: 3  
SHEET : 9 of 10  
DATE : 15.3.2011

| Date & Time |       | Fill pressure (Kg/Cm <sup>2</sup> ) | Flow Meter Reading (m <sup>3</sup> ) | Volume This Period (M <sup>3</sup> ) | Cummulative Volume ( M <sup>3</sup> ) |                              | Filled Water Temperature (°C) | REMARKS                |
|-------------|-------|-------------------------------------|--------------------------------------|--------------------------------------|---------------------------------------|------------------------------|-------------------------------|------------------------|
|             |       |                                     |                                      |                                      | Including Pre filling                 | Filled Volume after Sec. Pig |                               |                        |
|             | 2:30  | 4.5                                 | 30539                                | 41                                   | 14689                                 | 12549                        | 22.1                          |                        |
|             | 3:00  | 4.5                                 | 30583                                | 44                                   | 14733                                 | 12593                        | 22.1                          |                        |
|             | 3:30  | 4.5                                 | 30624                                | 41                                   | 14774                                 | 12634                        | 22.1                          | 210 ltrs remidol added |
|             | 4:00  | 4.5                                 | 30663                                | 39                                   | 14813                                 | 12673                        | 22.2                          |                        |
|             | 4:30  | 4.5                                 | 30703                                | 40                                   | 14853                                 | 12713                        | 22.2                          |                        |
|             | 5:00  | 4.5                                 | 30755                                | 52                                   | 14905                                 | 12765                        | 22.1                          |                        |
|             | 5:30  | 4.5                                 | 30795                                | 40                                   | 14945                                 | 12805                        | 22.1                          |                        |
|             | 6:00  | 4.5                                 | 30829                                | 34                                   | 14979                                 | 12839                        | 22.1                          |                        |
|             | 6:30  | 4.4                                 | 30889                                | 60                                   | 15039                                 | 12899                        | 22.6                          |                        |
|             | 7:00  | 4.6                                 | 30928                                | 39                                   | 15078                                 | 12938                        | 22.4                          |                        |
|             | 7:30  | 4.7                                 | 30971                                | 43                                   | 15121                                 | 12981                        | 22.5                          |                        |
|             | 8:00  | 4.7                                 | 31016                                | 45                                   | 15166                                 | 13026                        | 22.4                          |                        |
|             | 8:30  | 4.8                                 | 31061                                | 45                                   | 15211                                 | 13071                        | 22.6                          |                        |
|             | 9:00  | 4.8                                 | 31097                                | 36                                   | 15247                                 | 13107                        | 22.7                          |                        |
|             | 9:30  | 4.7                                 | 31146                                | 49                                   | 15296                                 | 13156                        | 22.9                          |                        |
|             | 10:00 | 4.7                                 | 31183                                | 37                                   | 15333                                 | 13193                        | 23.1                          |                        |
|             | 10:30 | 4.7                                 | 31232                                | 49                                   | 15382                                 | 13242                        | 23.2                          |                        |
|             | 11:00 | 4.7                                 | 31272                                | 40                                   | 15422                                 | 13282                        | 23.0                          |                        |
|             | 11:30 | 4.5                                 | 31332                                | 60                                   | 15482                                 | 13342                        | 23.0                          |                        |
|             | 12:00 | 4.5                                 | 31362                                | 30                                   | 15512                                 | 13372                        | 23.1                          |                        |
|             | 12:30 | 4.6                                 | 31395                                | 33                                   | 15545                                 | 13405                        | 28.4                          |                        |
|             | 13:00 | 5.0                                 | 31435                                | 40                                   | 15585                                 | 13445                        | 28.5                          |                        |
|             | 13:30 | 5.0                                 | 31484                                | 49                                   | 15634                                 | 13494                        | 28.4                          |                        |
|             | 14:00 | 6.0                                 | 31500                                | 16                                   | 15650                                 | 13510                        | 28.4                          |                        |
|             | 14:30 | 6.5                                 | 31543                                | 43                                   | 15693                                 | 13553                        | 28.5                          |                        |
|             | 15:00 | 6.5                                 | 31590                                | 47                                   | 15740                                 | 13600                        | 25.2                          |                        |
|             | 15:30 | 6.0                                 | 31652                                | 62                                   | 15802                                 | 13662                        | 23                            | 210 ltrs remidol added |
|             | 16:00 | 6.0                                 | 31689                                | 37                                   | 15839                                 | 13699                        | 22.6                          |                        |
|             | 16:30 | 6.0                                 | 31700                                | 11                                   | 15850                                 | 13710                        | 24.0                          |                        |
|             | 17:00 | 6.0                                 | 31725                                | 25                                   | 15875                                 | 13735                        | 24.0                          |                        |
|             | 17:30 | 6.0                                 | 31749                                | 24                                   | 15899                                 | 13759                        | 22.6                          |                        |

|        |  |            |  |
|--------|--|------------|--|
| KPTL   |  | EIL / HMPL |  |
| Sign : |  | Sign :     |  |
| Name : |  | Name :     |  |
| Date : |  | Date :     |  |

|                                                                                                                                                                                                          |  |                                       |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------|--|------------------------------------|-------|------------------|-------|-------|-------|-------|-------|-------|------------|------------------------|-------|-----------------------|-------|-------|-------|-------|-------|-----------------------------------|-------|----------|--------|-------|------------------------|--|--|--|--|
|                                                                                                                                                                                                          |  | KALPATARU POWER TRANSMISSION LIMITED. |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  | CLIENT : HMPL                         |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       | CONSULTANT : ENGINEERS INDIA LTD. |       |          |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  | THERMAL STABILIZATION                 |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  | Mundra Bathinda Pipeline Project      |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| 28"                                                                                                                                                                                                      |  | Spread : 1                            |  | REPORT NO. 03<br>Date : 16.03.2011 |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Section No. :                                                                                                                                                                                            |  | HT-2                                  |  | From: 0.000                        |       |                  |       |       |       |       |       |       |            | To: 161.35             |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Joint No. :                                                                                                                                                                                              |  |                                       |  | From: KM 35 FT34A                  |       |                  |       |       |       |       |       |       |            | To: KM 75 FT51A        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| OD ( mm )<br>711.2                                                                                                                                                                                       |  | Wall Thk. (mm)                        |  | ID ( mm )                          |       | Grade            |       |       |       |       |       |       |            |                        |       | Length :<br>40408.455 |       | mtrs  |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  | Min.: 9.5                             |  | Min.: 689.00                       |       | API - 5L Gr X 70 |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  | Max.: 11.1                            |  | Max.: 692.20                       |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  | Header 14.3                           |  | 682.60                             |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| S. NO.                                                                                                                                                                                                   |  | Time & Date<br>( HRS )                |  | Soil Temperature (°C)              |       |                  |       |       |       |       |       |       |            | Pipe Temperature (°C)  |       |                       |       |       |       |       |       |                                   |       | REMARK'S |        |       |                        |  |  |  |  |
|                                                                                                                                                                                                          |  |                                       |  | S-1                                | S-2   | S-3              | S-4   | S-5   | S-6   | S-7   | S-8   | S-9   | S-10       | AVE. SOIL<br>TEMP (°C) | P-1   | P-2                   | P-3   | P-4   | P-5   | P-6   | P-7   | P-8                               | P-9   |          |        | P-10  | AVE. PIPE<br>TEMP (°C) |  |  |  |  |
|                                                                                                                                                                                                          |  |                                       |  | CH-35                              | CH-39 | CH-43            | CH-47 | CH-51 | CH-54 | CH-59 | CH-65 | CH-71 | CH-75      |                        | CH-35 | CH-39                 | CH-43 | CH-47 | CH-51 | CH-54 | CH-59 | CH-65                             | CH-71 |          |        | CH-75 |                        |  |  |  |  |
| 1                                                                                                                                                                                                        |  | 10:00<br>16/03/2011                   |  | 28.4                               | 29.4  | 30.5             | 27.4  | 28.1  | 27.8  | 26.3  | 27.3  | 27.3  | 27.3       | 27.98                  | 27.8  | 30.1                  | 31.2  | 27.7  | 29.9  | 27.5  | 27.4  | 27.7                              | 27.5  | 28.60    | 28.540 |       |                        |  |  |  |  |
| 2                                                                                                                                                                                                        |  | 12:00<br>16/03/2011                   |  | 28.4                               | 29.4  | 30.5             | 27.5  | 28.2  | 27.7  | 26.4  | 27.6  | 27.5  | 27.9       | 28.11                  | 28.1  | 29.8                  | 30.9  | 27.8  | 28.3  | 27.7  | 27.8  | 28                                | 27.8  | 29.40    | 28.56  |       |                        |  |  |  |  |
| READINGS TO BE TAKEN AT EVERY 2 HOURS INTERVALS                                                                                                                                                          |  |                                       |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| THERMAL STABILIZATION BE CONSIDERED TO HAVE BEEN ACHIEVED, WHEN THE DIFFERENCE BETWEEN THE AVG. PIPE TEMP. AND AVG. SOIL TEMP. IS NOT HIGHER THAN 1 °C. FOR 2 CONSECUTIVE READINGS.                      |  |                                       |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| "C" VALUATION                                                                                                                                                                                            |  |                                       |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Difference between the average pipe wall temperature and soil temp in two consecutive readings found to be less than/ more than 1 °C and hence thermal stabilisation found to be achieved / not achieved |  |                                       |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Acceptance of section STABILIZATION : Yes/No                                                                                                                                                             |  |                                       |  |                                    |       |                  |       |       |       |       |       |       |            |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| KPTL                                                                                                                                                                                                     |  |                                       |  |                                    |       |                  |       |       |       |       |       |       | EIL / HMPL |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Sign :                                                                                                                                                                                                   |  |                                       |  |                                    |       |                  |       |       |       |       |       |       | Sign :     |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Name :                                                                                                                                                                                                   |  |                                       |  |                                    |       |                  |       |       |       |       |       |       | Name :     |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |
| Date :                                                                                                                                                                                                   |  |                                       |  |                                    |       |                  |       |       |       |       |       |       | Date :     |                        |       |                       |       |       |       |       |       |                                   |       |          |        |       |                        |  |  |  |  |

|  |                                                      |                             |  |
|--|------------------------------------------------------|-----------------------------|--|
|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b>          |                             |  |
|  | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                             |  |
|  | AIR - VOLUME CALCULATION                             |                             |  |
|  | Mundra Bathinda Pipeline Project                     |                             |  |
|  |                                                      | KPTL/MBPL/PL/029/F-09 Rev.0 |  |

|                     |                                      |
|---------------------|--------------------------------------|
| Line Dia: 28"       | Report No. : 3      Date : 3/17/2011 |
| Section No. HT - 02 | 100% CYCLE                           |
| Joint No.           | From KM 35 FT34A To KM 75 FT51A      |

Air Volume Test Carried out at 100% of Test Pressure

TEST STATION LOCATION:-CH-35 (SV-02)      TEST PRESSURE:- 116.59 BAR

|                      |                                 |                                             |
|----------------------|---------------------------------|---------------------------------------------|
| Dead Weight Tester : | Make: RAVIKA                    | Calibration certificate No.: DW-952, T7A251 |
|                      | Model REW 1109 HAO              | Date 04/03/2011                             |
|                      | Avg. Pipe Temp. ( °C ) - 29.275 |                                             |

|                                | Dead Weight Tester Bar | Pressure Lowering Bar | Volume of Water |
|--------------------------------|------------------------|-----------------------|-----------------|
| Initial                        | 116.59                 |                       |                 |
| Aftre First Pressure Lowering  | 116.09                 | 0.5                   | 587.000         |
| After Second Pressure Lowering | 115.59                 | 0.5                   | 587.590         |

**To Calculate the theatrical volume of water required to achieve a change in pressure, the volume presure equation is  $V_p = (0.884 ri/t+A) \times 10^{-6} \times V_t \times \Delta P \times K$**

Where :

|     |                                                                                                                               |              |
|-----|-------------------------------------------------------------------------------------------------------------------------------|--------------|
| Vp  | = Computed water amount required to raise by P The Pressure in the section to be tested ( m3 )                                | = 0.585835   |
| Vt  | = Geometrical Volume of the Section ( M3 )                                                                                    | = 15193.2711 |
| ri  | = Nominal inner radius of the pipe (mm)                                                                                       | = 346.1      |
| t   | = Nominal pipe thickness (mm)                                                                                                 | = 9.5        |
| A   | = Isothermal compressibility value for water at the pressurization temperature in the " P" range ( Bar-1 ) x 10.6 Refer graph | = 43.40      |
| Δ P | = Pressure rise in bar                                                                                                        | = 0.5        |
| K   | = A dimensionless coefficient that is equal to a Value of 1.02 for longitudinally welded pipe.                                | = 1.02       |

|                                                                           |                           |                        |
|---------------------------------------------------------------------------|---------------------------|------------------------|
| Threrfore $V_p$                                                           | = 0.585835 M <sup>3</sup> |                        |
|                                                                           | = 585.835 litre           |                        |
| Actual Volume of water drained to drop pressure by 0.5 kg/cm <sup>2</sup> |                           | = 587.000 Liter ( Vi ) |
| Threrfore $V_i / V_p$                                                     | = 1.0020                  |                        |

Acceptance of Air-Volume Ratio : YES / NO      YES

**Note:** In case the test section have multiple wall thickness, ri shall be correspond to the wall thickness which have max total length in the test section .

Remarks :-

Acceptance of The AIR VOLUME : Yes / No      YES

| KPTL   |  | EIL / HMPL |  |
|--------|--|------------|--|
| Sign : |  | Sign :     |  |
| Name : |  | Name :     |  |
| Date : |  | Date :     |  |

|                                                                                                                       | <b>KALPATARU POWER TRANSMISSION LIMITED</b>          |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------|------------------------------------|--------------|--------------------------|-------------------------------|-----------------|--------------------------|
|                                                                                                                       | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
|                                                                                                                       | <b>50 % PRESSURIZATION CYCLE</b>                     |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
|                                                                                                                       | Mundra Bathinda Pipeline Project                     |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Report No. :      3      Sheet No.      1                                                                             |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Date :      16.03.11                                                                                                  |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Spread :      1                                                                                                       |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Section: HT - 02      From: CH 00.00      To: CH 161.350                                                              |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Joint No.      From: KM 35 FT34A      To: KM 75FT51A                                                                  |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Test Medium      Water                                                                                                |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Section Length :<br>(mtrs)                                                                                            | Theoretical Volume :      (m <sup>3</sup> )          | Material :      API 5L X 70<br>Wall Thickness :      9.5,10.3,11.1,14.3 mm<br>Source of Water :      COT HMPL TANK -B MUNDRA |                   |                                    |              |                          |                               |                 |                          |
| 40408.455                                                                                                             | 15193.2711                                           |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| 1. Pressurization Pump :      Make- PRESSURE JET      Model :KD 50350      Discharge Pressure: 250 kg/cm <sup>2</sup> |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| 2. Dead Weight Tester :      Make: YANTRIKA      Model :REW1109HAO                                                    |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| Calibration Certificate No & Date : DW-952.T7A 251 & 04.03.2011                                                       |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| 3. Stroke Counter /Flow mtrs :      Make: woltex      Model/Sr.No-D100K085213K                                        |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
|                                                                                                                       |                                                      | Start Point                                                                                                                  | End Point         | Highest Point                      | Lowest Point |                          |                               |                 |                          |
| Chainage (KM)                                                                                                         |                                                      | 35.402                                                                                                                       | 75.767            | 44.331                             | 75.506       |                          |                               |                 |                          |
| Elevation (Mtr.)                                                                                                      |                                                      | 71.700                                                                                                                       | 20.020            | 112.810                            | 19.100       |                          |                               |                 |                          |
| Pressure (Bar)                                                                                                        |                                                      | 115.62                                                                                                                       | 120.68            | 111.59                             | 120.77       |                          |                               |                 |                          |
| S. NO.                                                                                                                | Date & Time                                          |                                                                                                                              | DEAD WT.<br>(Bar) | STROKE COUNTER/Flow mtr<br>READING |              | VOLUME<br>M <sup>3</sup> | CUM. VOL.      M <sup>3</sup> | Ambient TEMP °C | REMARKS                  |
|                                                                                                                       | Date                                                 | Time                                                                                                                         |                   | STROKE<br>COUNTER                  | FLOW METRE   |                          |                               |                 |                          |
| 1                                                                                                                     | 16.03.2011                                           | 14:10                                                                                                                        | 19.5              |                                    | 34013.0      | 0.00                     | 0.00                          | 32.4            | Pressurisation started   |
| 2                                                                                                                     | 16.03.2011                                           | 14:47                                                                                                                        | 24.5              |                                    | 34022.1      | 9.10                     | 9.10                          | 33.0            |                          |
| 3                                                                                                                     | 16.03.2011                                           | 15:15                                                                                                                        | 29.5              |                                    | 34029.0      | 6.90                     | 16.00                         | 32.0            |                          |
| 4                                                                                                                     | 16.03.2011                                           | 16:00                                                                                                                        | 35.0              |                                    | 34038.5      | 9.50                     | 25.50                         | 32.0            |                          |
| 5                                                                                                                     | 16.03.2011                                           | 16:30                                                                                                                        | 40.0              |                                    | 34044.1      | 5.60                     | 31.10                         | 30.9            |                          |
| 6                                                                                                                     | 16.03.2011                                           | 17:10                                                                                                                        | 45.0              |                                    | 34051.1      | 7.00                     | 38.10                         | 29.8            |                          |
| 7                                                                                                                     | 16.03.2011                                           | 17:40                                                                                                                        | 50.0              |                                    | 34058.5      | 7.40                     | 45.50                         | 29.2            |                          |
| 8                                                                                                                     | 16.03.2011                                           | 18:10                                                                                                                        | 55.0              |                                    | 34064.8      | 6.30                     | 51.80                         | 28.6            |                          |
| 9                                                                                                                     | 16.03.2011                                           | 18:25                                                                                                                        | 57.0              |                                    | 34067.3      | 2.50                     | 54.30                         | 28.3            |                          |
| 10                                                                                                                    | 16.03.2011                                           | 18:31                                                                                                                        | 58.0              |                                    | 34068.6      | 1.30                     | 55.60                         | 28.3            |                          |
| 11                                                                                                                    | 16.03.2011                                           | 18:40                                                                                                                        | 58.5              |                                    | 34069.2      | 0.60                     | 56.20                         | 28.3            | Pressurisation completed |
| Acceptance of The PRESSURIZATION : (Yes / No ) : .....YES                                                             |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
|                                                                                                                       |                                                      |                                                                                                                              |                   |                                    |              |                          |                               |                 |                          |
| KPTL                                                                                                                  |                                                      |                                                                                                                              |                   |                                    | EIL / HMPL   |                          |                               |                 |                          |
| Sign :                                                                                                                |                                                      |                                                                                                                              |                   |                                    | Sign :       |                          |                               |                 |                          |
| Name :                                                                                                                |                                                      |                                                                                                                              |                   |                                    | Name :       |                          |                               |                 |                          |
| Date :                                                                                                                |                                                      |                                                                                                                              |                   |                                    | Date :       |                          |                               |                 |                          |

|  |                                             |  |                                   |  |                              |
|--|---------------------------------------------|--|-----------------------------------|--|------------------------------|
|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b> |  |                                   |  |                              |
|  | CLIENT : HMPL                               |  | CONSULTANT : ENGINEERS INDIA LTD. |  |                              |
|  | <b>PRESSURIZATION</b>                       |  |                                   |  |                              |
|  | Mundra Bathinda Pipeline Project            |  |                                   |  |                              |
|  |                                             |  |                                   |  | KPTL HMPL PL-029 F 08, Rev.0 |

|                   |                                  |                   |                  |
|-------------------|----------------------------------|-------------------|------------------|
| Spread : 1        | Cycle : 75%                      | Report No. : 3    | Sheet No. 1 OF 1 |
| Section No: HT-02 | From: CH 0.000 To: CH 161.350    | Date : 17/03/2011 |                  |
| Joint No.         | From: KM 35 FT34A To: KM 75FT51A |                   |                  |
| Test Medium       | Water                            |                   |                  |

|                         |                                        |                                           |
|-------------------------|----------------------------------------|-------------------------------------------|
| Section Length : (mtrs) | Theoritical Volume : (m <sup>3</sup> ) | Material : API 5L X 70                    |
| 40408.455               | 15193.2711                             | Wall Thickness : 9.5,10.3,11.1,14.3 mm    |
|                         |                                        | Source of Water : COT HMPL TANK -B MUNDRA |

1. Pressurization Pump : Make- PRESSURE JET Model : KD 50350 Discharge Pressure: 250 kg/cm<sup>2</sup>

2. Dead Weight Tester : Make: YANTRIKA Model : REW 1109 HAO

Calibration Certificate No & Date : DW-952, T7A251 & 04/03/2011

3. Stroke Counter /Flow mtrs : Make: wollex Model/Sr.No-D100K085213K

|                  | Start Point | End Point | Highest Point | Lowest Point |
|------------------|-------------|-----------|---------------|--------------|
| Chainage (KM)    | 35.402      | 75.767    | 44.331        | 75.506       |
| Elevation (Mtr.) | 71.700      | 20.020    | 112.810       | 19.100       |
| Pressure (Bar)   | 115.62      | 120.68    | 111.59        | 120.77       |

| S. NO. | Date & Time |       | DWT Reading (Bar) | STROKE COUNTER/Flow mtr READING |                 | VOLUME M <sup>3</sup> | CUM. VOL. M <sup>3</sup> | Ambient TEMP °C | REMARKS                  |
|--------|-------------|-------|-------------------|---------------------------------|-----------------|-----------------------|--------------------------|-----------------|--------------------------|
|        | Date        | Time  |                   | STROKE COUNTER                  | FLOW METRE (m3) |                       |                          |                 |                          |
| 1      | 16/03/2011  | 23:40 | 20                | -----                           | 34070.0         | 0.000                 | 0.00                     | 22.3            | Pressurisation started   |
| 2      | 17/03/2011  | 0:18  | 25                | -----                           | 34079.5         | 9.50                  | 9.50                     | 21.8            |                          |
| 3      |             | 0:40  | 30                | -----                           | 34086.1         | 6.60                  | 16.10                    | 21.4            |                          |
| 4      |             | 0:58  | 35                | -----                           | 34093.0         | 6.90                  | 23.00                    | 21.3            |                          |
| 5      |             | 1:17  | 40                | -----                           | 34100.3         | 7.30                  | 30.30                    | 20.9            |                          |
| 6      |             | 1:36  | 45                | -----                           | 34107.7         | 7.40                  | 37.70                    | 20.6            |                          |
| 7      |             | 2:02  | 50                | -----                           | 34113.0         | 5.30                  | 43.00                    | 20.3            |                          |
| 8      |             | 2:35  | 55                | -----                           | 34120.7         | 7.70                  | 50.70                    | 19.8            |                          |
| 9      |             | 3:02  | 60                | -----                           | 34123.3         | 2.60                  | 53.30                    | 19.8            |                          |
| 10     |             | 3:35  | 65                | -----                           | 34133.0         | 9.70                  | 63.00                    | 19.6            |                          |
| 11     |             | 4:05  | 70                | -----                           | 34138.7         | 5.70                  | 68.70                    | 19.4            |                          |
| 12     |             | 4:34  | 75                | -----                           | 34144.3         | 5.60                  | 74.30                    | 19.3            |                          |
| 13     |             | 5:00  | 80                | -----                           | 34150.0         | 5.70                  | 80.00                    | 19.4            |                          |
| 14     |             | 5:12  | 82                | -----                           | 34152.5         | 2.50                  | 82.50                    | 19.4            |                          |
| 15     |             | 5:25  | 84                | -----                           | 34155.0         | 2.50                  | 85.00                    | 19.5            |                          |
| 16     |             | 5:32  | 85                | -----                           | 34156.5         | 1.45                  | 86.45                    | 19.5            |                          |
| 17     |             | 5:37  | 86                | -----                           | 34157.9         | 1.45                  | 87.90                    | 19.4            |                          |
| 18     |             | 5:43  | 87                | -----                           | 34159.4         | 1.45                  | 89.35                    | 19.4            | Pressurisation completed |
| 19     |             | 5:50  | 88                | -----                           | 34160.8         | 1.45                  | 90.80                    | 19.4            |                          |

Acceptance of The PRESSURIZATION : (Yes / No ) : .....YES

Note :- Readings to be recorded for every 5 Bar increment upto 80%, 80% to 90% is 2 Bar and 90% to 100% is 0.5 Bar.

|        |            |
|--------|------------|
| KPTL   | EIL / HMPL |
| Sign : | Sign :     |
| Name : | Name :     |
| Date : | Date :     |

[illegible]

|                                                                                                                                                                                                                                                                                                                                             | <b>KALPATARU POWER TRANSMISSION LIMITED</b>                 |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------|-----------------|-----------|--------------|-----------------|--------------------------|
|                                                                                                                                                                                                                                                                                                                                             | <b>CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD.</b> |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
|                                                                                                                                                                                                                                                                                                                                             | <b>PRESSURIZATION</b>                                       |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
|                                                                                                                                                                                                                                                                                                                                             | Mundra Bathinda Pipeline Project                            |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
|                                                                                                                                                                                                                                                                                                                                             |                                                             | Report No. :                                                                                                                 | 3 Sheet No. 1 OF 1 |                                 |                 |           |              |                 |                          |
|                                                                                                                                                                                                                                                                                                                                             |                                                             | Date :                                                                                                                       | 17/03/2011         |                                 |                 |           |              |                 |                          |
| Spread : 1      Cycle : 75%                                                                                                                                                                                                                                                                                                                 |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
| Section No: HT-02      From: CH 0.000      To: CH 161.350                                                                                                                                                                                                                                                                                   |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
| Joint No.      From: KM 35 FT34A      To: KM 75FT51A                                                                                                                                                                                                                                                                                        |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
| Test Medium      Water                                                                                                                                                                                                                                                                                                                      |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
| Section Length :<br>(mtrs)<br><br>40408.455                                                                                                                                                                                                                                                                                                 | Theoretical Volume :      (m³)<br><br>15193.2711            | Material :      API 5L X 70<br>Wall Thickness :      9.5,10.3,11.1,14.3 mm<br>Source of Water :      COT HMPL TANK -B MUNDRA |                    |                                 |                 |           |              |                 |                          |
| 1. Pressurization Pump :      Make- PRESSURE JET      Model :KD 50350      Discharge Pressure: 250 kg/cm²<br>2. Dead Weight Tester :      Make: YANTRIKA      Model :REW 1109 HAO<br>Calibration Certificate No & Date :      DW-952, T7A251 & 04/03/2011<br>3. Stroke Counter /Flow mtrs :      Make: woltex      Model/Sr.No-D100K085213K |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
|                                                                                                                                                                                                                                                                                                                                             | Start Point                                                 | End Point                                                                                                                    | Highest Point      | Lowest Point                    |                 |           |              |                 |                          |
| Chainage (KM)                                                                                                                                                                                                                                                                                                                               | 35.402                                                      | 75.767                                                                                                                       | 44.331             | 75.506                          |                 |           |              |                 |                          |
| Elevation (Mtr.)                                                                                                                                                                                                                                                                                                                            | 71.700                                                      | 20.020                                                                                                                       | 112.810            | 19.100                          |                 |           |              |                 |                          |
| Pressure (Bar)                                                                                                                                                                                                                                                                                                                              | 115.62                                                      | 120.68                                                                                                                       | 111.59             | 120.77                          |                 |           |              |                 |                          |
| S. NO.                                                                                                                                                                                                                                                                                                                                      | Date & Time                                                 |                                                                                                                              | DWT Reading (Bar)  | STROKE COUNTER/Flow mtr READING |                 | VOLUME M³ | CUM. VOL. M³ | Ambient TEMP °C | REMARKS                  |
|                                                                                                                                                                                                                                                                                                                                             | Date                                                        | Time                                                                                                                         |                    | STROKE COUNTER                  | FLOW METRE (m3) |           |              |                 |                          |
| 1                                                                                                                                                                                                                                                                                                                                           | 16/03/2011                                                  | 23:40                                                                                                                        | 20                 | -----                           | 34070.0         | 0.000     | 0.00         | 22.3            | Pressurisation started   |
| 2                                                                                                                                                                                                                                                                                                                                           | 17/03/2011                                                  | 0:18                                                                                                                         | 25                 | -----                           | 34079.5         | 9.50      | 9.50         | 21.8            |                          |
| 3                                                                                                                                                                                                                                                                                                                                           |                                                             | 0:40                                                                                                                         | 30                 | -----                           | 34086.1         | 6.60      | 16.10        | 21.4            |                          |
| 4                                                                                                                                                                                                                                                                                                                                           |                                                             | 0:58                                                                                                                         | 35                 | -----                           | 34093.0         | 6.90      | 23.00        | 21.3            |                          |
| 5                                                                                                                                                                                                                                                                                                                                           |                                                             | 1:17                                                                                                                         | 40                 | -----                           | 34100.3         | 7.30      | 30.30        | 20.9            |                          |
| 6                                                                                                                                                                                                                                                                                                                                           |                                                             | 1:36                                                                                                                         | 45                 | -----                           | 34107.7         | 7.40      | 37.70        | 20.6            |                          |
| 7                                                                                                                                                                                                                                                                                                                                           |                                                             | 2:02                                                                                                                         | 50                 | -----                           | 34113.0         | 5.30      | 43.00        | 20.3            |                          |
| 8                                                                                                                                                                                                                                                                                                                                           |                                                             | 2:35                                                                                                                         | 55                 | -----                           | 34120.7         | 7.70      | 50.70        | 19.8            |                          |
| 9                                                                                                                                                                                                                                                                                                                                           |                                                             | 3:02                                                                                                                         | 60                 | -----                           | 34123.3         | 2.60      | 53.30        | 19.8            |                          |
| 10                                                                                                                                                                                                                                                                                                                                          |                                                             | 3:35                                                                                                                         | 65                 | -----                           | 34133.0         | 9.70      | 63.00        | 19.6            |                          |
| 11                                                                                                                                                                                                                                                                                                                                          |                                                             | 4:05                                                                                                                         | 70                 | -----                           | 34138.7         | 5.70      | 68.70        | 19.4            |                          |
| 12                                                                                                                                                                                                                                                                                                                                          |                                                             | 4:34                                                                                                                         | 75                 | -----                           | 34144.3         | 5.60      | 74.30        | 19.3            |                          |
| 13                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:00                                                                                                                         | 80                 | -----                           | 34150.0         | 5.70      | 80.00        | 19.4            |                          |
| 14                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:12                                                                                                                         | 82                 | -----                           | 34152.5         | 2.50      | 82.50        | 19.4            |                          |
| 15                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:25                                                                                                                         | 84                 | -----                           | 34155.0         | 2.50      | 85.00        | 19.5            |                          |
| 16                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:32                                                                                                                         | 85                 | -----                           | 34156.5         | 1.45      | 86.45        | 19.5            |                          |
| 17                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:37                                                                                                                         | 86                 | -----                           | 34157.9         | 1.45      | 87.90        | 19.4            |                          |
| 18                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:43                                                                                                                         | 87                 | -----                           | 34159.4         | 1.45      | 89.35        | 19.4            | Pressurisation completed |
| 19                                                                                                                                                                                                                                                                                                                                          |                                                             | 5:50                                                                                                                         | 88                 | -----                           | 34160.8         | 1.45      | 90.80        | 19.4            |                          |
| Acceptance of The PRESSURIZATION : (Yes / No ) : .....YES                                                                                                                                                                                                                                                                                   |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
| Note :- Readings to be recorded for every 5 Bar increment upto 80%, 80% to 90% is 2 Bar and 90% to 100% is 0.5 Bar.                                                                                                                                                                                                                         |                                                             |                                                                                                                              |                    |                                 |                 |           |              |                 |                          |
| KPTL                                                                                                                                                                                                                                                                                                                                        |                                                             |                                                                                                                              |                    |                                 | EIL / HMPL      |           |              |                 |                          |
| Sign :                                                                                                                                                                                                                                                                                                                                      |                                                             |                                                                                                                              |                    |                                 | Sign :          |           |              |                 |                          |
| Name :                                                                                                                                                                                                                                                                                                                                      |                                                             |                                                                                                                              |                    |                                 | Name :          |           |              |                 |                          |
| Date :                                                                                                                                                                                                                                                                                                                                      |                                                             |                                                                                                                              |                    |                                 | Date :          |           |              |                 |                          |

|  |                                                      |                              |  |
|--|------------------------------------------------------|------------------------------|--|
|  | KALPATARU POWER TRANSMISSION LIMITED                 |                              |  |
|  | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                              |  |
|  | PRESSURIZATION                                       |                              |  |
|  | Mundra Bathinda Pipeline Project                     |                              |  |
|  |                                                      | KPTL MBPL PL-029 I-08, Rev.0 |  |

Spread : 1

Section HT-02

Joint No.

Test Medium

Cycle : 100%

From: CH 0.000 To: CH 161.350

From: KM 35 FT34A To: KM 75FT51A

Water

Report No. : 3

Date : 17.01.11

Sheet No. 1 OF 2

|                            |                                        |                                           |
|----------------------------|----------------------------------------|-------------------------------------------|
| Section Length :<br>(mtrs) | Theoretical Volume : (m <sup>3</sup> ) | Material : API 5L X 70                    |
| 40408.455                  | 15193.2711                             | Wall Thickness : 9.5,10.3,11.1,14.3 mm    |
|                            |                                        | Source of Water : COT HMPL TANK -B MUNDRA |

1. Pressurization Pump :      Make- PRESSURE JET      Model :KD 50350      Discharge Pressure: 250 kg/cm<sup>2</sup>

2. Dead Weight Tester :      Make: Yantrika      Model :REW 109 HAO

Calibration Certificate No & Date : DW-952, T7A251 & 04/03/2011

3. Stroke Counter /Flow mtrs :      Make: wollex      Model/Sr.No-D100K085213K

|                  | Start Point | End Point | Highest Point | Lowest Point |
|------------------|-------------|-----------|---------------|--------------|
| Chainage (KM)    | 35.402      | 75.767    | 44.331        | 75.506       |
| Elevation (Mtr.) | 71.700      | 20.020    | 112.810       | 19.100       |
| Pressure (Bar)   | 115.62      | 120.68    | 111.59        | 120.77       |

| S. NO. | Date & Time |       | DEAD WT. Bar | STROKE COUNTER/Flow mtr READING |            | VOLUME M <sup>3</sup> | CUM. VOL. M <sup>3</sup> | Ambient Temp °C | REMARKS                |
|--------|-------------|-------|--------------|---------------------------------|------------|-----------------------|--------------------------|-----------------|------------------------|
|        | Date        | Time  |              | STROKE COUNTER                  | FLOW METRE |                       |                          |                 |                        |
| 1      | 17/03/2011  | 11:45 | 20           | -----                           | 34160.9    | 0.00                  | 0.00                     | 29.1            | Pressurisation started |
| 2      |             | 11:55 | 25           | -----                           | 34165.0    | 4.10                  | 4.10                     | 29.5            |                        |
| 3      |             | 12:10 | 30           | -----                           | 34173.1    | 8.10                  | 12.20                    | 30.4            |                        |
| 4      |             | 12:27 | 35           | -----                           | 34181.6    | 8.50                  | 20.70                    | 31.6            |                        |
| 5      |             | 12:40 | 40           | -----                           | 34187.2    | 5.60                  | 26.30                    | 32.0            |                        |
| 6      |             | 12:55 | 45           | -----                           | 34193.5    | 6.30                  | 32.60                    | 32.5            |                        |
| 7      |             | 13:20 | 50           | -----                           | 34200.0    | 6.50                  | 39.10                    | 33.4            |                        |
| 8      |             | 13:52 | 55           | -----                           | 34205.3    | 5.30                  | 44.40                    | 34.2            |                        |
| 9      |             | 14:26 | 60           | -----                           | 34212.6    | 7.30                  | 51.70                    | 33.9            |                        |
| 10     |             | 15:35 | 65           | -----                           | 34219.7    | 7.10                  | 58.80                    | 32.7            |                        |
| 11     |             | 15:55 | 70           | -----                           | 34225.6    | 5.90                  | 64.70                    | 31.4            |                        |
| 12     |             | 16:25 | 75           | -----                           | 34231.6    | 6.00                  | 70.70                    | 29.8            |                        |
| 13     |             | 17:00 | 80           | -----                           | 34237.1    | 5.50                  | 76.20                    | 28.3            |                        |
| 14     |             | 17:30 | 85           | -----                           | 34243.2    | 6.10                  | 82.30                    | 27.2            |                        |
| 15     |             | 17:58 | 90           | -----                           | 34249.0    | 5.80                  | 88.10                    | 26.2            |                        |
| 16     |             | 18:30 | 95           | -----                           | 34255.1    | 6.10                  | 94.20                    | 25.4            |                        |

Acceptance of The PRESSURIZATION : (Yes / No ) : .....

Note :- Readings to be recorded for every 5 Bar increment upto 80%, 80% to 90% is 2 Bar and 90% to 100% is 0.5 Bar.

|        |            |
|--------|------------|
| KPTL   | EIL / HMPL |
| Sign : | Sign :     |
| Name : | Name :     |
| Date : | Date :     |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                               |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------------|----|----------------------------------------------|------------|--|---------------------------------------------------|--|----|--------------------------------------------|------------|----|-----------------------------------------|-------|---|-------------------------------|-----|---|-------------------------------------------------------------------------------------------------------------------------------|-------|-----|------------------------|---------|---|------------------------------------------------------------------------------------------------|------|--------------|---|-------------------------|--|---|---------------|---------------------------------------------------------------------------|--|----------------------|-------------------|---|--------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>KALPATARU POWER TRANSMISSION LIMITED</b>                                                                                   |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | CLIENT : HMPL                                                                                                                 | CONSULTANT : ENGINEERS INDIA LTD. |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>AIR - VOLUME CALCULATION</b>                                                                                               |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Mundra Bathinda Pipeline Project                                                                                              |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                               | Report No. : 3                    | Date : 16.03.2011     |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| <p>Line Dia: 28"      50% CYCLE</p> <p>Section No. HT - 02      Joint No.      From KM 35 FT34A To KM 75 FT51A</p> <p>Test Section Length: 40408.455 mtrs      Volume: 15193.2711 M<sup>3</sup></p> <p style="text-align: center;">Air Volume Test Carried out at 50 % of Test Pressure</p> <p>Test Station Location :-CH-35(SV-02)      Test Pressure: 58.76 bar</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                               |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| <p>Dead Weight Tester :      Make: RAVIKA      Calibration certificate No.: DW-952</p> <p style="text-align: center;">Model REW1109HAO      Date 16/03/2011</p> <p style="text-align: center;">Avg. Pipe Temp. ( °C ) - 28.86</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                               |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Dead Weight Tester Bar                                                                                                        | Pressure Lowering Bar             | Volume of Water(LTRS) |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Initial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 58.76                                                                                                                         |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| After First Pressure Lowering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 58.26                                                                                                                         | 0.5                               | 595.200               |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| After Second Pressure Lowering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 57.76                                                                                                                         | 0.5                               | 598.340               |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| <p><b>To Calculate the theoretical volume of water required to achieve a change in pressure, the volume pressure equation is</b> <math>V_p = (0.884 \text{ ri}/t \times A) \times 10^{-6} \times V_t \times \Delta P \times K</math></p> <p>Where :</p> <table style="width: 100%;"> <tr> <td style="width: 15%;">Vp</td> <td style="width: 55%;">= Computed water amount required to raise by</td> <td style="width: 30%; text-align: right;">505.126000</td> </tr> <tr> <td></td> <td>P The Pressure in the section to be tested ( m3 )</td> <td></td> </tr> <tr> <td>Vt</td> <td>= Geometrical Volume of the Section ( M3 )</td> <td style="text-align: right;">15193.2711</td> </tr> <tr> <td>ri</td> <td>= Nominal inner radius of the pipe (mm)</td> <td style="text-align: right;">346.1</td> </tr> <tr> <td>t</td> <td>= Nominal pipe thickness (mm)</td> <td style="text-align: right;">9.5</td> </tr> <tr> <td>A</td> <td>= Isothermal compressibility value for water at the pressurization temperature in the " P" range ( Bar-1 ) x 10.6 Refer graph</td> <td style="text-align: right;">44.10</td> </tr> <tr> <td>Δ P</td> <td>= Pressure rise in bar</td> <td style="text-align: right;">0.5 BAR</td> </tr> <tr> <td>K</td> <td>= A dimensionless coefficient that is equal to a Value of 1.02 for longitudinally welded pipe.</td> <td style="text-align: right;">1.02</td> </tr> <tr> <td>Therefore Vp</td> <td>=</td> <td style="text-align: right;">0.591278 M<sup>3</sup></td> </tr> <tr> <td></td> <td>=</td> <td style="text-align: right;">591.278 litre</td> </tr> <tr> <td>Actual Volume of water drained to drop pressure by 0.5 kg/cm<sup>2</sup></td> <td></td> <td style="text-align: right;">595.200 Liter ( Vi )</td> </tr> <tr> <td>Therefore Vi / Vp</td> <td>=</td> <td style="text-align: right;">1.0066</td> </tr> </table> <p>Acceptance of Air-Volume Ratio : YES / NO      YES</p> <p><b>Note:</b> In case the test section have multiple wall thickness, ri shall be correspond to the wall thickness which have max total length in the test section .</p> <p>Remarks :-</p> <p>Acceptance of The AIR VOLUME : Yes / No</p> |                                                                                                                               |                                   |                       | Vp | = Computed water amount required to raise by | 505.126000 |  | P The Pressure in the section to be tested ( m3 ) |  | Vt | = Geometrical Volume of the Section ( M3 ) | 15193.2711 | ri | = Nominal inner radius of the pipe (mm) | 346.1 | t | = Nominal pipe thickness (mm) | 9.5 | A | = Isothermal compressibility value for water at the pressurization temperature in the " P" range ( Bar-1 ) x 10.6 Refer graph | 44.10 | Δ P | = Pressure rise in bar | 0.5 BAR | K | = A dimensionless coefficient that is equal to a Value of 1.02 for longitudinally welded pipe. | 1.02 | Therefore Vp | = | 0.591278 M <sup>3</sup> |  | = | 591.278 litre | Actual Volume of water drained to drop pressure by 0.5 kg/cm <sup>2</sup> |  | 595.200 Liter ( Vi ) | Therefore Vi / Vp | = | 1.0066 |
| Vp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | = Computed water amount required to raise by                                                                                  | 505.126000                        |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | P The Pressure in the section to be tested ( m3 )                                                                             |                                   |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Vt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | = Geometrical Volume of the Section ( M3 )                                                                                    | 15193.2711                        |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| ri                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | = Nominal inner radius of the pipe (mm)                                                                                       | 346.1                             |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| t                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | = Nominal pipe thickness (mm)                                                                                                 | 9.5                               |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | = Isothermal compressibility value for water at the pressurization temperature in the " P" range ( Bar-1 ) x 10.6 Refer graph | 44.10                             |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Δ P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | = Pressure rise in bar                                                                                                        | 0.5 BAR                           |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | = A dimensionless coefficient that is equal to a Value of 1.02 for longitudinally welded pipe.                                | 1.02                              |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Therefore Vp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | =                                                                                                                             | 0.591278 M <sup>3</sup>           |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | =                                                                                                                             | 591.278 litre                     |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Actual Volume of water drained to drop pressure by 0.5 kg/cm <sup>2</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                               | 595.200 Liter ( Vi )              |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Therefore Vi / Vp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | =                                                                                                                             | 1.0066                            |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| KPTL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                               | EIL / HMPL                        |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Sign :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                               | Sign :                            |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Name :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                               | Name :                            |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |
| Date :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                               | Date :                            |                       |    |                                              |            |  |                                                   |  |    |                                            |            |    |                                         |       |   |                               |     |   |                                                                                                                               |       |     |                        |         |   |                                                                                                |      |              |   |                         |  |   |               |                                                                           |  |                      |                   |   |        |

|                                                                                                                                                                                                     |                                                      |                                                                                                                                            |                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                                                                                                                                                                                     | KALPATARU POWER TRANSMISSION LIMITED                 |                                                                                                                                            |                        |
|                                                                                                                                                                                                     | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                                                                                                                                            |                        |
|                                                                                                                                                                                                     | AIR - VOLUME CALCULATION                             |                                                                                                                                            |                        |
|                                                                                                                                                                                                     | Mundra Bathinda Pipeline Project                     |                                                                                                                                            |                        |
|                                                                                                                                                                                                     |                                                      | Report No. : 3      Date : 3/17/2011                                                                                                       |                        |
| 75% CYCLE                                                                                                                                                                                           |                                                      |                                                                                                                                            |                        |
| Line Dia: 28"                                                                                                                                                                                       |                                                      | Joint No.      From KM 35 FT34A To KM 75 FT51A                                                                                             |                        |
| Section No. HT - 02                                                                                                                                                                                 |                                                      | Volume: 15193.2711 M3                                                                                                                      |                        |
| Test Section Length: 40408.455 mtrs                                                                                                                                                                 |                                                      | Air Volume Test Carried out at 75% of Test Pressure                                                                                        |                        |
| TEST STATION LOCATION - CH-35 (SV-02)                                                                                                                                                               |                                                      | TEST PRESSURE :- 88.1 BAR                                                                                                                  |                        |
| Dead Weight Tester :                                                                                                                                                                                |                                                      | Make: RAVIKA      Calibration certificate No.: DW-952, T7A251<br>Model REW 1109 HAO      Date 4/03/2011<br>Avg. Pipe Temp. ( °C ) - 23.525 |                        |
|                                                                                                                                                                                                     | Dead Weight Tester Bar                               | Pressure Lowering Bar                                                                                                                      | Volume of Water        |
| Initial                                                                                                                                                                                             | 88.10                                                |                                                                                                                                            |                        |
| After First Pressure Lowering                                                                                                                                                                       | 87.60                                                | 0.5                                                                                                                                        | 590.000                |
| After Second Pressure Lowering                                                                                                                                                                      | 87.10                                                | 0.5                                                                                                                                        | 591.000                |
| To Calculate the theoretical volume of water required to achieve a change in pressure, the volume pressure equation is $V_p = (0.884 \, ri/t+A) \times 10^{-6} \times V_t \times \Delta P \times K$ |                                                      |                                                                                                                                            |                        |
| Where :                                                                                                                                                                                             |                                                      |                                                                                                                                            |                        |
| $V_p$                                                                                                                                                                                               | =                                                    | Computed water amount required to raise by P The Pressure in the section to be tested ( m3 )                                               | = 0.5031               |
| $V_t$                                                                                                                                                                                               | =                                                    | Geometrical Volume of the Section ( M3 )                                                                                                   | = 15193.2711           |
| $ri$                                                                                                                                                                                                | =                                                    | Nominal inner radius of the pipe (mm)                                                                                                      | = 346.1                |
| $t$                                                                                                                                                                                                 | =                                                    | Nominal pipe thickness (mm)                                                                                                                | = 9.5                  |
| $A$                                                                                                                                                                                                 | =                                                    | Isothermal compressibility value for water at the pressurization temperature in the " P" range ( Bar-1 ) x 10.6 Refer graph                | = 43.85                |
| $\Delta P$                                                                                                                                                                                          | =                                                    | Pressure rise in bar                                                                                                                       | = 0.5                  |
| $K$                                                                                                                                                                                                 | =                                                    | A dimensionless coefficient that is equal to a Value of 1.02 for longitudinally welded pipe.                                               | = 1.02                 |
| Therefore $V_p$                                                                                                                                                                                     | =                                                    | 0.589321 M <sup>3</sup>                                                                                                                    |                        |
|                                                                                                                                                                                                     | =                                                    | 589.321 litre                                                                                                                              |                        |
| Actual Volume of water drained to drop pressure by 0.5 kg/cm <sup>2</sup>                                                                                                                           |                                                      |                                                                                                                                            | = 590.000 Liter ( Vi ) |
| Therefore $V_i / V_p$                                                                                                                                                                               | =                                                    | 1.0012                                                                                                                                     |                        |
| Acceptance of Air-Volume Ratio : YES / NO                                                                                                                                                           |                                                      |                                                                                                                                            |                        |
| <b>Note:</b> In case the test section have multiple wall thickness, $ri$ shall be correspond to the wall thickness which have max total length in the test section .                                |                                                      |                                                                                                                                            |                        |
| Remarks :-                                                                                                                                                                                          |                                                      |                                                                                                                                            |                        |
| Acceptance of The AIR VOLUME : Yes / No                                                                                                                                                             |                                                      |                                                                                                                                            |                        |
| KPTL                                                                                                                                                                                                |                                                      | EIL / HMPL                                                                                                                                 |                        |
| Sign :                                                                                                                                                                                              |                                                      | Sign :                                                                                                                                     |                        |
| Name :                                                                                                                                                                                              |                                                      | Name :                                                                                                                                     |                        |
| Date :                                                                                                                                                                                              |                                                      | Date :                                                                                                                                     |                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                      |                                                |                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------|----------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>KALPATARU POWER TRANSMISSION LIMITED</b>          |                                                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                                                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>HYDROTATIC TEST CALCULATIONS</b>                  |                                                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Mundra Bathinda Pipeline Project                     |                                                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                      | Report No. : <b>3</b><br>Date :      3/19/2011 |                            |
| Line Dia : 28"      From: CH 0.000      To : CH 161.350<br>Section No. HT- 02      Joint No. From: KM 35 FT34A      To : KM 75FT51A<br>Test Section Length: 40408.455 mtrs      Volume: 15193.2711 M3<br>Test Station Location Ch 35 (SV-02)      Test Pressure: 115.62 Bar<br>Dead Weight Tester      Make: Ravika      Calibration Certificate No.: DW952      Sr. No.: T7A251<br>Model : REW1109HA0      Date: 4/03/2011                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                      |                                                |                            |
| Temperature Recorder      Make: G TEK      Calibration certificate No. RE 576      Sr no- 108550911                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                      | Model : CR2010      Date 04/03/2011            |                            |
| Temperature Recorder      Make: G TEK      Calibration certificate No. RE 576      Sr no- 108550911                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                      | Model : CR2010      Date 04/03/2011            |                            |
| Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Elevation In Mtrs                                    | Pressure In Bar                                |                            |
| Pressurisation Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 71.700                                               | 115.62                                         |                            |
| Receiving Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 20.020                                               | 120.69                                         |                            |
| Highest Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 112.810                                              | 111.59                                         |                            |
| Lowest Point                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 19.100                                               | 120.77                                         |                            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Date                                                 | Time                                           | Dead Weight Tester ( Bar ) |
| Start of Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 18.03.2011                                           | 11:30 AM                                       | 115.62                     |
| End of Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 19/03/2011                                           | 11:30                                          | 115.44                     |
| Algebraic Difference                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |                                                | 0.1800                     |
| Average Pipe Temp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                      |                                                |                            |
| 0.15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |                                                |                            |
| Calculation of Pressure Change ( P ) due to Δ change in temperature :<br><br>$\Delta p = \frac{B \times \Delta T}{0.884 \times r_i / t + A}$ Where :<br>$\Delta p$ Pressure change resulting from temperature change (bar) = 0.520<br><br>$B = \left\{ \begin{array}{l} \text{Value of the Difference between thermal expansion of water and} \\ \text{steel at temperature and pressure as measured from enclosed table} \\ \text{at the end of the test ( } ^\circ\text{C}^{-1} ) \times 10^6 \end{array} \right. = 262.523$<br>$r_i = \text{Nominal inner radius of pipe ( mm )} = 346.1$<br>( in case of the test section having multiple wall thicknesses, "r" shall correspond to the wall thickness, having max. total length. )<br>$t = \text{Nominal wall thickness of pipe ( mm )} = 9.5$<br>$A = \text{Isothermal compressibility factor of water ( Bar}^{-1} ) \times 10^6 = 43.50$<br>$\Delta T = \text{Algebraical difference between water temperature at beginning and at end of the test. ( } ^\circ\text{C )} = 0.15$ |                                                      |                                                |                            |
| KPTL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      | EIL / HMPL                                     |                            |
| Sign :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      | Sign :                                         |                            |
| Name :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      | Name :                                         |                            |
| Date :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      | Date :                                         |                            |

|  |                                                      |                              |  |
|--|------------------------------------------------------|------------------------------|--|
|  | <b>KALPATARU POWER TRANSMISSION LIMITED</b>          |                              |  |
|  | CLIENT : HMPL      CONSULTANT : ENGINEERS INDIA LTD. |                              |  |
|  | HYDROSTATIC TEST EVALUATION                          |                              |  |
|  | Mundra Bathinda Pipeline Project                     |                              |  |
|  |                                                      | KPTL/HBPL/PL-029/F-12 Rev..0 |  |

|                                                        |                                                       |
|--------------------------------------------------------|-------------------------------------------------------|
| REPORT N      3      DATE      3/19/2011               |                                                       |
| Spread : 1                                             | From: CH00      To: CH 161.35      Section No. HT- 02 |
| Joint No.      From: KM 35 FT 34A      To: KM 75 FT51A |                                                       |

|            |                |               |                    |                                    |
|------------|----------------|---------------|--------------------|------------------------------------|
| O D ( mm ) | Wall Thk. (mm) | I D (mm)      | Grade              | Length : 40408.455 mtr             |
| 711.2      | Min. : 9.5     | Min. : 692.20 | API -5L<br>GR.X 70 | Volume : 15193.2711 m <sup>3</sup> |
|            | Max. : 11.1    | Max. : 689.00 |                    |                                    |
|            | Header 14.3    | 682.60        |                    |                                    |

|                      |                    |                 |                 |
|----------------------|--------------------|-----------------|-----------------|
| Section No. HT- 02   | From: KM 35 FT 34A | To: KM 75 FT51A |                 |
| Description          | Elevation in Mtrs  |                 | Pressure in Bar |
| Pressurisation Point | 71.700             |                 | 115.62          |
| Receiving Point      | 20.020             |                 | 120.69          |
| Highest Point        | 112.810            |                 | 111.59          |
| Lowest Point         | 19.100             |                 | 120.77          |

|                                                 |     |        |      |           |               |
|-------------------------------------------------|-----|--------|------|-----------|---------------|
| <b>OBSERVATIONS :</b>                           |     |        |      |           |               |
| Initial Test Pressure                           | Bar | 115.62 | Date | 3/18/2011 | Time 11:30    |
| Final Test Pressure                             | Bar | 115.44 | Date | 3/19/2011 | Time 11:30    |
| (A) Delta " P " during 24 hours Hold Period :   |     |        |      |           |               |
| Initial Pipe Wall Temp                          | °C  | 28.14  | Date | 3/18/2011 | Time 11:30 AM |
| Final Pipe Wall Temp                            | °C  | 27.99  | Date | 3/19/2011 | Time 11:30 AM |
| ( B ) Delta " T " during 24 hours Hold Period : |     |        |      |           |               |
| Initial Soil Temp                               | °C  | 28.13  | Date | 3/18/2011 | Time 11:30 AM |
| Final Soil Temp                                 | °C  | 27.9   | Date | 3/19/2011 | Time 11:30 AM |
| ( c ) Delta T, Soil Temp:                       |     |        |      |           |               |

|                                                                               |         |     |                      |
|-------------------------------------------------------------------------------|---------|-----|----------------------|
| <b>EVALUATION :</b>                                                           |         |     |                      |
| (1) Delta " P " during 24 hours hold period ( A )                             | 0.18    | Bar |                      |
| (2) Accountable pressure loss due to temp. ( B )                              | 0.520   | Bar |                      |
| (3) Final test pressure after accounting pressure loss due to change in Temp. | 115.960 | Bar |                      |
| (4) Difference between initial and final test Pressure                        | -0.340  | Bar | ( RAISE IN PRESSURE) |

|                                                                                |  |                      |
|--------------------------------------------------------------------------------|--|----------------------|
| <b>CONCLUSION :</b>                                                            |  | <b>TEST ACCEPTED</b> |
| Test is Acceptable / Not Acceptable ( Strike out whichever is not applicable ) |  | YES                  |
| Section is released for depressurisation :      Yes / No                       |  |                      |

|                      |  |
|----------------------|--|
| REMARKS ( if any ) : |  |
|----------------------|--|

|        |            |
|--------|------------|
| KPTL   | EIL / HMPL |
| Sign : | Sign :     |
| Name : | Name :     |
| Date : | Date :     |

|                                                                                                                                                                                                                                                                                     |            | <b>KALPATARU POWER TRANSMISSION LIMITED</b>                |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------|----------------------------------|-----------------------|-------|-------|-------|-------|-------|-------------------------------------------------------------------------------|-------|------------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|---------|------|-----------------|
|                                                                                                                                                                                                                                                                                     |            | <b>CLIENT: HMPL      CONSULTANT : ENGINEERS INDIA LTD.</b> |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
|                                                                                                                                                                                                                                                                                     |            | <b>PRESSURE TEST ( 24 HOURS HOLD )</b>                     |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
|                                                                                                                                                                                                                                                                                     |            | <b>Mundra Bathinda Pipeline project</b>                    |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| KPTL/HMPL/PL/0291-10 Rev 0                                                                                                                                                                                                                                                          |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Line Dia : 28"      Spread : 1                                                                                                                                                                                                                                                      |            |                                                            |                                  |                       |       |       |       |       |       | REPORT NO.: 3      SHEET : 1 of 2                                             |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Section No. HT-02      From: CH 0.00      To: CH 161.350                                                                                                                                                                                                                            |            |                                                            |                                  |                       |       |       |       |       |       | Date : 19.03.11                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Joint No.:      From: KM 35 FT34A      To: KM 75FT51A                                                                                                                                                                                                                               |            |                                                            |                                  |                       |       |       |       |       |       | Dead Wt Tester :      Make : Ravika      Model : REW 1109 HAO                 |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Location      Elevation (mtrs)      Pressure (Bar)                                                                                                                                                                                                                                  |            |                                                            |                                  |                       |       |       |       |       |       | Certificate No : DW-952, & 04/03/2011      Sr.No.: T7A252                     |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Pressurisation Point      71.700      115.62                                                                                                                                                                                                                                        |            |                                                            |                                  |                       |       |       |       |       |       | Pressure Recorder      Make : G-TEK      Model : CR-2010                      |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Receiving Point      20.020      120.69                                                                                                                                                                                                                                             |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Highest Point      112.810      111.59                                                                                                                                                                                                                                              |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Lowest Point      19.100      120.77                                                                                                                                                                                                                                                |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| <div style="display: flex; justify-content: space-between;"> <div> OD ( mm )<br/>711.2 </div> <div> Test pr. Req'd at station(Bar)<br/> Min.: 109.96      Max.: 122.49 </div> <div> I.D. mm<br/> Min.: 692.20      Max.: 689.00 </div> <div> Grade<br/> API - 5L X 70 </div> </div> |            |                                                            |                                  |                       |       |       |       |       |       | Length of test Section : 40408.455 mtrs<br>Volume : 15193.2711 m <sup>3</sup> |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| S. NO.                                                                                                                                                                                                                                                                              | Date       | Time                                                       | Dead Weight Tester Reading (BAR) | Soil Temperature (°C) |       |       |       |       |       |                                                                               |       |            |       | Pipe Temperature (°C) |       |       |       |       |       |       |       |       |       | Ambient Temp. (°C) | REMARKS |      |                 |
|                                                                                                                                                                                                                                                                                     |            |                                                            |                                  | S-1                   | S-2   | S-3   | S-4   | S-5   | S-6   | S-7                                                                           | S-8   | S-9        | S-10  | Ave. Soil Temp.       | P-1   | P-2   | P-3   | P-4   | P-5   | P-6   | P-7   | P-8   | P-9   |                    |         | P-10 | Ave. Pipe Temp. |
|                                                                                                                                                                                                                                                                                     |            |                                                            |                                  | CH-35                 | CH-39 | CH-43 | CH-47 | CH-51 | CH-54 | CH-59                                                                         | CH-65 | CH-71      | CH-75 |                       | CH-35 | CH-39 | CH-43 | CH-47 | CH-51 | CH-54 | CH-59 | CH-65 | CH-71 | CH-75              |         |      |                 |
| 1                                                                                                                                                                                                                                                                                   | 18.03.2011 | 11:30                                                      | 115.62                           | 29.8                  | 28.6  | 27.9  | 27.7  | 27.8  | 28.2  | 27.7                                                                          | 27.5  | 27.5       | 28.6  | 28.13                 | 29.7  | 28.7  | 27.7  | 27.4  | 28.0  | 27.8  | 28.0  | 27.4  | 27.2  | 29.5               | 28.14   | 27.7 | HOLDING STARTS  |
| 2                                                                                                                                                                                                                                                                                   | 18.03.2011 | 12:30                                                      | 115.61                           |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         | 29.5 |                 |
| 3                                                                                                                                                                                                                                                                                   | 18.03.2011 | 13:30                                                      | 115.60                           | 29.7                  | 28.5  | 28.2  | 27.8  | 27.9  | 27.8  | 27.3                                                                          | 27.7  | 27.4       | 27.8  | 28.01                 | 29.8  | 29.0  | 28.4  | 27.7  | 28.1  | 27.9  | 28.1  | 27.9  | 27.7  | 29.6               | 28.42   | 31.1 |                 |
| 4                                                                                                                                                                                                                                                                                   | 18.03.2011 | 14:30                                                      | 115.60                           |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         | 31.5 |                 |
| 5                                                                                                                                                                                                                                                                                   | 18.03.2011 | 15:30                                                      | 115.60                           | 29.8                  | 28.6  | 29.1  | 27.8  | 28.1  | 27.8  | 27.4                                                                          | 28.0  | 27.5       | 27.8  | 28.19                 | 30.0  | 28.9  | 28.6  | 27.6  | 28.7  | 28.2  | 28.4  | 28.1  | 27.9  | 29.8               | 28.62   | 30.8 |                 |
| 6                                                                                                                                                                                                                                                                                   | 18.03.2011 | 16:30                                                      | 115.60                           |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         | 27.9 |                 |
| 7                                                                                                                                                                                                                                                                                   | 18.03.2011 | 17:30                                                      | 115.59                           | 29.6                  | 28.7  | 29.1  | 27.8  | 27.3  | 27.9  | 27.5                                                                          | 27.8  | 27.9       | 28.4  | 28.20                 | 29.8  | 28.8  | 28.6  | 27.7  | 28.2  | 28.4  | 28.7  | 27.8  | 28.1  | 30.3               | 28.64   | 25.8 |                 |
| DEAD WEIGHT TESTER READINGS TO BE RECORDED AT EVERY HOUR. PIPE & SOIL TEMPERATURE READINGS TO BE RECORDED EVERY 2 HOUR.                                                                                                                                                             |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| REMARKS :                                                                                                                                                                                                                                                                           |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Acceptance of Test Pressure ( 24 HOURS HOLD ) : Yes / No                                                                                                                                                                                                                            |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       |            |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| KPTL                                                                                                                                                                                                                                                                                |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       | EIL / HMPL |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Sign :                                                                                                                                                                                                                                                                              |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       | Sign :     |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Name :                                                                                                                                                                                                                                                                              |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       | Name :     |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |
| Date :                                                                                                                                                                                                                                                                              |            |                                                            |                                  |                       |       |       |       |       |       |                                                                               |       | Date :     |       |                       |       |       |       |       |       |       |       |       |       |                    |         |      |                 |

|                               |  |                                                            |  |                             |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |
|-------------------------------|--|------------------------------------------------------------|--|-----------------------------|--|--|--|--|--|--|--|--|--|----------------------------|--|--|--|--|--|--|--|--|--|
|                               |  | <b>KALPATARU POWER TRANSMISSION LIMITED</b>                |  |                             |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |
|                               |  | <b>CLIENT: HMPL      CONSULTANT : ENGINEERS INDIA LTD.</b> |  |                             |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |
|                               |  | <b>PRESSURE TEST ( 24 HOURS HOLD )</b>                     |  |                             |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |
|                               |  | <b>Mundra Bathinda Pipeline project</b>                    |  |                             |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |
| <b>Line Dia :      28"</b>    |  | <b>Spread :      1</b>                                     |  | <b>REPORT NO.:      3</b>   |  |  |  |  |  |  |  |  |  | <b>SHEET :      2 of 2</b> |  |  |  |  |  |  |  |  |  |
| <b>Section No.      HT-02</b> |  | <b>From:      CH 0.000      To:      CH-161.35</b>         |  | <b>Date :      19.03.11</b> |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |
| <b>Joint No. :</b>            |  | <b>From:      KM 35 FT34A      To:      KM75 FT51A</b>     |  |                             |  |  |  |  |  |  |  |  |  |                            |  |  |  |  |  |  |  |  |  |

| S. NO. | Date       | Time  | DWT Reading (BAR) | Soil Temperature (°C) |       |       |       |       |       |       |       |       |       | Pipe Temperature (°C) |       |       |       |       |       |       |       |       |       | Average Pipe Temp. | Ambient Temp. (°C) | REMARKS |  |  |      |             |
|--------|------------|-------|-------------------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------------------|--------------------|---------|--|--|------|-------------|
|        |            |       |                   | S-1                   | S-2   | S-3   | S-4   | S-5   | S-6   | S-7   | S-8   | S-9   | S-10  | P-1                   | P-2   | P-3   | P-4   | P-5   | P-6   | P-7   | P-8   | P-9   | P-10  |                    |                    |         |  |  |      |             |
|        |            |       |                   | CH-35                 | CH-39 | CH-43 | CH-47 | CH-51 | CH-54 | CH-59 | CH-65 | CH-61 | CH-75 | CH-35                 | CH-39 | CH-43 | CH-47 | CH-51 | CH-54 | CH-59 | CH-65 | CH-61 | CH-75 |                    |                    |         |  |  |      |             |
| 8      | 18.03.2011 | 18:30 | 115.56            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 24.6 |             |
| 9      | 18.03.2011 | 19:30 | 115.53            | 29.6                  | 28.4  | 29.1  | 27.7  | 27.5  | 28.1  | 26.4  | 27.7  | 27.9  | 28.4  | 28.08                 | 29.7  | 28.7  | 28.5  | 27.7  | 28.0  | 28.3  | 27.5  | 27.8  | 28.0  | 29.6               | 28.38              |         |  |  | 23.1 |             |
| 10     | 18.03.2011 | 20:30 | 115.53            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 22.4 |             |
| 11     | 18.03.2011 | 21:30 | 115.52            | 29.5                  | 28.3  | 29.1  | 27.5  | 27.7  | 28.1  | 26.4  | 27.7  | 28.0  | 28.3  | 28.06                 | 29.7  | 28.6  | 28.4  | 27.6  | 27.9  | 28.2  | 27.4  | 27.8  | 28.0  | 28.5               | 28.21              |         |  |  | 21.5 |             |
| 12     | 18.03.2011 | 22:30 | 115.52            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 20.4 |             |
| 13     | 18.03.2011 | 23:30 | 115.52            | 29.3                  | 28.1  | 28.9  | 27.4  | 27.7  | 28.2  | 26.5  | 27.6  | 27.8  | 28.1  | 27.96                 | 29.6  | 28.5  | 28.2  | 27.5  | 27.8  | 28.1  | 27.3  | 27.7  | 27.9  | 28.2               | 28.08              |         |  |  | 19.6 |             |
| 14     | 19/03/2011 | 0:30  | 115.52            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 18.5 |             |
| 15     | 19/03/2011 | 1:30  | 115.48            | 29.2                  | 28.0  | 28.8  | 27.3  | 27.6  | 28.1  | 26.4  | 27.5  | 27.7  | 28.0  | 27.86                 | 29.5  | 28.4  | 28.1  | 27.4  | 27.7  | 28.0  | 27.3  | 27.6  | 27.8  | 28.1               | 27.99              |         |  |  | 17.4 |             |
| 16     | 19/03/2011 | 2:30  | 115.47            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 17.3 |             |
| 17     | 19/03/2011 | 3:30  | 115.46            | 29.1                  | 27.9  | 28.7  | 27.5  | 27.5  | 28.0  | 26.4  | 27.5  | 27.6  | 27.9  | 27.81                 | 29.4  | 28.3  | 28.0  | 27.3  | 27.6  | 28.0  | 27.2  | 27.5  | 27.7  | 28.0               | 27.90              |         |  |  | 17.1 |             |
| 18     | 19/03/2011 | 4:30  | 115.46            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 16.9 |             |
| 19     | 19/03/2011 | 5:30  | 115.44            | 29.0                  | 27.8  | 28.5  | 27.5  | 27.5  | 28.0  | 26.4  | 27.5  | 27.5  | 27.8  | 27.75                 | 29.3  | 28.2  | 27.9  | 27.2  | 27.5  | 27.8  | 27.2  | 27.3  | 27.6  | 28.0               | 27.80              |         |  |  | 16.5 |             |
| 20     | 19/03/2011 | 6:30  | 115.42            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 16.0 |             |
| 21     | 19/03/2011 | 7:30  | 115.42            | 29.0                  | 27.8  | 27.7  | 27.5  | 27.6  | 28.3  | 26.8  | 27.3  | 27.2  | 27.4  | 27.66                 | 29.3  | 28.3  | 27.7  | 27.1  | 27.2  | 27.9  | 27.2  | 27.2  | 27.4  | 27.6               | 27.69              |         |  |  | 15.9 |             |
| 22     | 19/03/2011 | 8:30  | 115.42            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 16.1 |             |
| 23     | 19/03/2011 | 9:30  | 115.42            | 29.0                  | 27.8  | 27.6  | 27.5  | 28.1  | 28.1  | 27.0  | 27.1  | 27.5  | 28.6  | 27.83                 | 29.4  | 28.4  | 27.8  | 27.2  | 27.5  | 27.8  | 27.4  | 27.2  | 27.2  | 28.1               | 27.80              |         |  |  | 17.6 |             |
| 24     | 19/03/2011 | 10:30 | 115.43            |                       |       |       |       |       |       |       |       |       |       |                       |       |       |       |       |       |       |       |       |       |                    |                    |         |  |  | 18.9 |             |
| 25     | 19/03/2011 | 11:30 | 115.44            | 29.1                  | 28.4  | 27.7  | 27.5  | 27.9  | 28.1  | 27.6  | 27.4  | 27.3  | 28.0  | 27.90                 | 29.5  | 28.5  | 27.5  | 27.3  | 28.1  | 27.7  | 27.8  | 27.2  | 27.0  | 29.3               | 27.99              |         |  |  | 23.0 | HOLD FINISH |

**REMARKS :**  
 Acceptance of Test Pressure ( 24 HOURS HOLD ) : Yes / No

|        |  |            |  |
|--------|--|------------|--|
| KPTL   |  | EIL / HMPL |  |
| Sign : |  | Sign :     |  |
| Name : |  | Name :     |  |
| Date : |  | Date :     |  |

[illegible]

[illegible]

|                                                                                   |                                               |                       |              |                       |                |                                                                                     |
|-----------------------------------------------------------------------------------|-----------------------------------------------|-----------------------|--------------|-----------------------|----------------|-------------------------------------------------------------------------------------|
|  | KALPATARU POWER TRANSMISSION LIMITED          |                       |              |                       |                |  |
|                                                                                   | CLIENT: HMPL CONSULTANT: ENGINEERS INDIA LTD. |                       |              |                       |                |                                                                                     |
|                                                                                   | LIST OF INSTRUMENTS                           |                       |              |                       |                |                                                                                     |
|                                                                                   | Mundra Bathinda Pipeline Project              |                       |              |                       |                |                                                                                     |
| REPORT NO.: 3 DATE: 3/5/2011                                                      |                                               |                       |              |                       |                |                                                                                     |
| SR. NO.                                                                           | ITEM DISCRPTIONS                              | MAKE & MODEL          | S. NO.       | RANGE                 | CERTIFICATE NO | CALIBRATION DATE /VALIDITY DATE                                                     |
| 1                                                                                 | Dead Weight Tester                            | RAVIKA & REW 1109 HAO | T7A251       | 2 -250 Bar            | DW-952         | 4/3/2011 TO 03/03/2012                                                              |
| 2                                                                                 | Pressure Recorder                             | G-Tek & CR-2010       | 108430911    | 0-250 Bar             | RE-576         | 4/3/2011 TO 03/03/2012                                                              |
| 3                                                                                 | Temp. Recorder                                | G-Tek & CR-2010       | 108440911    | 0- 250 Bar & 0-100 °C | RE-576         | 4/3/2011 TO 03/03/2012                                                              |
| 4                                                                                 | Tempreture Sensor                             | Hemson & RTD PT 100   | 562          | 0-100°C               | RE-576         | 4/3/2011 TO 03/03/2012                                                              |
| 5                                                                                 | Flow Meter                                    | WOLTEX                | D100K085213K | 99999999 M³           | FL-179         | 4/3/2011 TO 03/03/2012                                                              |
| 7                                                                                 | Digital Temp.Indicator                        | Premier & PE 221P RTD | 10470        | 0-60°C                | T-5183         | 4/3/2011 TO 03/03/2012                                                              |
| 8                                                                                 | Digital Temp.Indicator                        | Premier & PE 221P RTD | 9358         | 0-60°C                | T-5184         | 4/3/2011 TO 03/03/2012                                                              |
| 9                                                                                 | Digital Temp.Indicator                        | Premier & PE 221P RTD | 12213        | 0-60°C                | T-5186         | 4/3/2011 TO 03/03/2012                                                              |
| 10                                                                                | Digital Temp.Indicator                        | Premier & PE 221P RTD | 12218        | 0-60°C                | T-5187         | 4/3/2011 TO 03/03/2012                                                              |
| 11                                                                                | Digital Temp.Indicator                        | Premier & PE 221P RTD | 11418        | 0-60°C                | T-5188         | 4/3/2011 TO 03/03/2012                                                              |
| 12                                                                                | Digital Temp.Indicator                        | Premier & PE 221P RTD | 11857        | 0-60°C                | T-5189         | 4/3/2011 TO 03/03/2012                                                              |
| 13                                                                                | RTD Sensor                                    | Premier & RTD         | 12104        | 0-60°C                | T-4859         | 21/06/2010 to 20/06/2011                                                            |
| 14                                                                                | RTD Sensor                                    | Premier & RTD         | 5190         | 0-60°C                | T-5190         | 4/3/2011 TO 03/03/2012                                                              |
| 15                                                                                | RTD Sensor                                    | Premier & RTD         | 5191         | 0-60°C                | T-5191         | 4/3/2011 TO 03/03/2012                                                              |
| 16                                                                                | RTD Sensor                                    | Premier & RTD         | 5192         | 0-60°C                | T-5192         | 4/3/2011 TO 03/03/2012                                                              |
| 17                                                                                | RTD Sensor                                    | Premier & RTD         | 12176        | 0-60°C                | T-5193         | 4/3/2011 TO 03/03/2012                                                              |
| 18                                                                                | RTD Sensor                                    | Premier & RTD         | 4079         | 0-60°C                | T-5194         | 4/3/2011 TO 03/03/2012                                                              |
| 19                                                                                | RTD Sensor                                    | Premier & RTD         | 12196        | 0-60°C                | T-5195         | 4/3/2011 TO 03/03/2012                                                              |
| 20                                                                                | RTD Sensor                                    | Premier & RTD         | 12100        | 0-60°C                | T-5196         | 4/3/2011 TO 03/03/2012                                                              |
| 21                                                                                | RTD Sensor                                    | Premier & RTD         | 12401        | 0-60°C                | T-5197         | 4/3/2011 TO 03/03/2012                                                              |
| 22                                                                                | RTD Sensor                                    | Premier & RTD         | 12172        | 0-60°C                | T-5198         | 4/3/2011 TO 03/03/2012                                                              |
| 23                                                                                | Pressure Gauge                                | Waaree                | 1574-P8-337  | 0- 280 Kg/cm2         | PG-1035        | 18/12/2010 to 17/12/2011                                                            |
| 24                                                                                | Pressure Gauge                                | Spencer               | A-10-08      | 0-210 Kg/cm2          | PG-1255        | 4/3/2011 TO 03/03/2012                                                              |
| 25                                                                                | Pressure Gauge                                | Spencer               | A-10-09      | 0-210 Kg/cm2          | PG-1254        | 4/3/2011 TO 03/03/2012                                                              |
| 26                                                                                |                                               |                       |              |                       |                |                                                                                     |
| 27                                                                                |                                               |                       |              |                       |                |                                                                                     |
| 28                                                                                |                                               |                       |              |                       |                |                                                                                     |
| KPTL                                                                              |                                               |                       | EIL / HMPL   |                       |                |                                                                                     |
| Sign :                                                                            |                                               |                       | Sign :       |                       |                |                                                                                     |
| Name :                                                                            |                                               |                       | Name :       |                       |                |                                                                                     |
| Date :                                                                            |                                               |                       | Date :       |                       |                |                                                                                     |

## **4. MAJOR ACTIVITY OF PIPELINE**

### **RIGHT OF USE ACQUISITION**

The ROU boundary lines are staked so as to prepare the strip for laying the pipeline. All construction activities are performed within the prescribed width limits of the ROU.

Prior to start of the clearing operations benchmarks are installed at intersection points and other required survey monuments. The markers are coloured red for easy identification and are maintained till permanent markers are installed. Two boundary markers are staked at two edges of ROU with numbers painted in white, at least 100 meters intervals.

### **ROU CLEARING AND GRADING**

Any obstacle in ROU hindering installation of pipeline along the pipeline route shall be removed. Grading of ROU is done as required for proper installation of the pipeline. All grubbed stumps, timber, bush, undergrowth and roots removed from the right of way are disposed off in a satisfactory method.

Grading of sharp points or low points is done to allow pipe to be bent and laid within the elastic limits and drill, blast or excavate any rock or other material which cannot be graded off with ordinary grading equipment in order to make an adequate working space along the pipeline.

### **STRINGING OF LINE PIPES**

From the pipe yard line pipes will be transported by means of flat bed trailers with proper safety measures to avoid any damage to the pipes. Unloading of pipes is done using cranes, side booms with the help of lifting clamps, spreader bars. The inside surface of the lifting clamps shall be provided with soft material to avoid damage to the bevels. The pipe will be placed at a distance of about 2 meters from the edge of the excavated trench on bags filled with soil free of stones, sand/straw free of stones to avoid any damage to pipe coating.

Dragging and sliding of pipes is not permitted. The pipes are placed inclined to the axis of the laying centreline with a gap of around 600mm for ease of inspection and bevelling. The pipes are supported both ends..

Pipes are wedged to prevent rolling off.

Stringing activity is done during day time in light and after cleaning and grading activity is completed. Stringing is done in such a manner as to cause least interference with the normal use of ROU.

Visual inspection is done and damaged and defective pipes are repaired or rejected. Further, care shall be taken to string pipes as per alignment sheets to ensure that pipes of the correct wall thickness are placed in single length along the trench line and also to verify that pipes are strung as per class requirement.

Transportation from Pipe Yard to Site along with arrangement of line pipe on trailers is carried out.

Following are the rules for stringing of line pipe as per approved procedures.

- Unloading of pipes shall be performed using Sideboom fitted with extended boom or crane depending on site condition.
- The Sideboom/Crane shall have SWL Certificate.
- Qualified operator shall operate Sideboom/Crane.
- Spreader bar shall be used in case of Sideboom for off loading the pipes.
- Spreader bar shall be fitted with two number lifting wire slings.
- Rubber Padded pipe lifting clamps shall be attached to the lifting slings.
- 2 guide ropes shall be attached to both end of lifting clamp.
- Stringing shall be taken up in the stretches where the ROW is graded and trench is cleared.
- Stringing of pipes minimum of 3 KM in advance of the mainline welding spread depending on the clear trench available.

Line pipes are unloaded from the pipe trailers and evenly strung along the ROW and positioned by means of side boom with extended boom

The pipes are supported, sandbags/soft soil bags free from stone & covered with a plastic film Or on wooden supports or dry germ free straw with plastic film which is positioned in such a way to prevent its rolling off into the ditch/ROW.

The height of the supports is minimum 300 mm. The pipes shall be stacked as a slope so that during rain does not collect inside the pipe.

The pipes are strung along pipeline route as per specified AFC alignment Sheet/drawings for proper placement of pipe by spec., thickness, grade & class other specifications.

Gaps in the string line pipe are to be left for passage of personnel, equipment livestock.

Line pipe is strung 1.5 to 2m from edge of trench to centreline to allow for safe working on both sides of strung pipes.

Stringing will be done in /out to permit access for bevel cleaning.

## **TRENCHING**

Trenchers/Excavators will be used for digging pipeline trench on cleared and graded ROW in cultivated lands and other areas

top 30 cm of arable soil on the pipeline trench top width plus 500mm on either side shall be excavated and stored separately and same is to be replaced in original position after the backfilling and compacting rest of the trench. It is required that fresh soil recovered from trenching operation, intended to use for backfilling over the laid pipe in the trench is not mixed with loose debris or foreign material. The excavated material shall never be deposited over against the strung pipe.

The depth of the trench will be such as to provide minimum cover as stipulated below for reference:

- |                                              |              |
|----------------------------------------------|--------------|
| i) Industrial, Commercial & Residential Area | - 1.00 meter |
|----------------------------------------------|--------------|

|                                                               |                                                    |
|---------------------------------------------------------------|----------------------------------------------------|
| ii) Minor Water Crossings/Canal/Drain/Nala/Stream             | - 1.50 meter                                       |
| iii) Drainage ditches at road & railroads                     | - 1.00 meter                                       |
| iv) Rocky Terrain                                             | - 1.00 meter                                       |
| vi) Uncased / Cased road crossing                             | - 1.20 meter                                       |
| vi) Rail/ Road Crossing                                       | - 1.70 meter                                       |
| vii) Other areas                                              | - 1.00 meter                                       |
| viii) River Crossing for which defined below lowest bed level | - 2.50 meter                                       |
| ix) Water Crossing by HDD (below lowest bed level)            | - 2.50 meter                                       |
| x) Marshy land/Creek area                                     | - 1.50 meter                                       |
| xi) Other River Crossing (bank width 50meters)                | - 2.50 meter (Below normal bed level in soft soil) |
|                                                               | {In Rocky Strata} - 1.50 mete                      |

Incase pipeline is located within 15 meters from any dwelling unit the cover shall be increased by 300mm over & above that specified. However requirements of cover mentioned in the alignment sheet / drawing shall govern.

Excavation to additional depth where the pipeline approaches and crosses other pipeline, sewers, drain pipes, water mains, telephone conduits, and other underground structures, so that the pipeline may be laid with at least 50 cm free clearance from the obstacle or as specified in the drawings, or such greater minimum distances as may be required by authorities having jurisdiction.

Excavation to additional depth at all the points where the contour of the earth may require extra depth to fit the minimum radius of the bend and as specified or eliminate unnecessary bending of the pipe according to the customary good pipeline practices, or where a deep trench is required at the approaches to crossings of roadways, railroads, rivers, streams, drainage ditches.

## **BENDING**

Cold field bend shall be made as explained below :

Trigonometric Survey will be done by the surveyor to establish number and degree of Bends required ensuring that the installed pipe will confirm to the contours of the trench.

Cold field bend radius shall not be less than 40 times of the nominal diameter.

Bending machines shall be capable of making bends without wrinkles, buckle, stretching and with minimum damage to the coating.

Contractor shall qualify the bending procedure as per the recommendations of the manufacturer of bending machine, prior to launch of bending operation, and all parameters are to be recorded by KPTL and approved by EIL.

Over bends shall be made in such a manner that the center of the bend clears the high points of the trench bottom. Sag bends shall fit the bottom of the trench and side bends shall conform and leave specific clearance to the outside wall of the trench.

Pipes with longitudinal welds shall be bent in such a way that the weld lies in the plane passing through the neutral axis of the bend, which shall be installed positioning the longitudinal weld. If horizontal deviations are to be achieved by joining more adjacent bends, the bending of the pipe lengths shall be made by positioning the longitudinal welds alternatively 70 mm above and below the plane passing through the neutral axis in such a way that the bends are welded with longitudinal welds displaced by about 150 mm and situated in the upper quadrants. In case of vertical bends formed from a number of pipe lengths, the longitudinal welds shall be positioned on the plane passing through the neutral axis of the bend to the right and left alternatively.

The pads, dies and rolls of the bending equipment shall have relatively soft surface to avoid damage to the pipe coating, wherever applicable, fully retaining bending shoes shall be used.

The ends of each bend length shall be straight and not involved anyway in the bending. The length of the straight section shall permit easy joining. In no event shall the end of the bend be closer than 1.5 m from the end of a pipe or within one meter of a girth weld.

The ovalization caused on each pipe by bending shall be less than 2.5% of the nominal diameter at any point. A check shall be performed on all bends in the presence of MBPL / EIL by passing a gauge plate consisting of two discs with a diameter equal to 95% of the nominal internal diameter of the pipe connected rigidly together at a distance equal to 300 mm. Thinning should be as per EIL specification.

Cold bend pipes on site shall have the corrosion coating carefully checked with the aid of a holiday detector for cracks in the coating down to the pipe wall. It shall be checked whether the coating has disbonded from the pipe wall during bending by beating with a wooden mallet along the outer radius. Any defects or disbonding of the coating caused during bending shall be repaired

All bends showing buckling wrinkles, cracks or other visible defects or which are in anyway disagreement shall be rejected.

When pipelines are laid in parallel, the horizontal bends shall be concentric.

Preferably provide for changes of vertical and horizontal alignment by making elastic bends. Provide cold field bends, at its option for change of direction and change of slope. MBPL/ EIL at its option may authorize fabricated bends for installation at points wherein MBPL / EIL's judgement the use of such bends is unavoidable.

Over-bends shall be made in such a manner that the center of the bend clears the high points of the trench bottom. Sag bends shall fit the bottom of the trench and side bends shall conform and leave specified clearance to the outside wall of the trench.

#### **Mitre and Unsatisfactory Bends**

All bends showing buckling, wrinkles, cracks or other visible defects or which are in anyway in disagreement, in whole or in part, with this specification shall be rejected.

No mitre bends shall be permitted in the construction of the pipeline. KPTL shall cut out and remove any bend or bends, which do not meet the specifications and shall replace the same with satisfactory bends.

Cutting of factory made bends and cold field bends for any purpose shall not be permitted.

### **WELD JOINT NUMBERING**

All joints to be welded shall be numbered as indicated below:

#### **Mainline Joints**

K XX / M YY / A - C - E - G      Flow Direction  
B - D - F - H      

Here:

- XX indicates chainage in Kilometer eg. The welds between kilometer KM 0 and KM 01 are indicated as K 00 and the welds between kilometer KM 01 and KM 02 are indicated as K 01
- YY indicates the joint number eg. The weld joint number between KM 0 and KM 01 are indicated as K 00/ M 01, K 00 / M 02 etc. If there is discontinuity in weld section, the UN welded joint is temporary recorded as open end in mainline welding progress report and later on the same will be numbered as per Tie – In or Free Tie – In joint numbering system mentioned in next page.
- A&B are Root welder ID numbers
- C&D are Hot Pass welder ID numbers
- E&F are Filler-1 welder ID numbers
- G&H are Filler & Capping welder ID numbers
- M indicates Main Line.

The joints welded inside trench or welding 2 sections above trench and not subjected to any stresses will be considered as free tie – in joints and same will numbered as below.

**Here:**

- ### Tie-In Weld Joints

**Here:**

- XX indicates chain age in Kilometer **eg.** The welds between kilometer KM 0 and KM 01 are indicated as K 00 and the welds between kilometer KM 01 and KM 02 are indicated as K 01.
- YY indicates the joint number **eg.** The weld joint number between KM 00 / M 02 & KM 00 / M 04 will be numbered as K 00 / T 03.
- A&B are Root, Hot pass & Filler-1 welder ID numbers
- G&H are Filler & Capping welder ID numbers

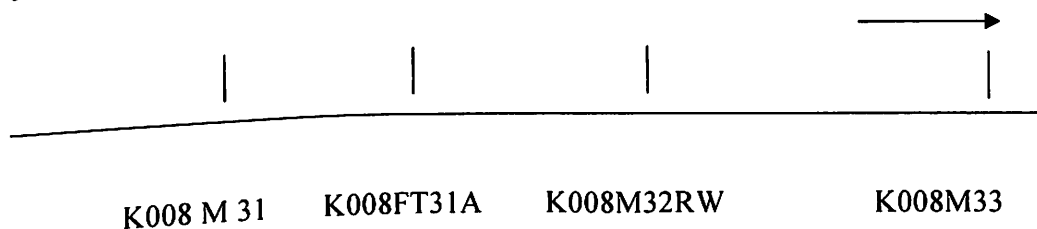
### **Repair and Reweld Joints:**

Any joint subjected to repair shall be suffixed with letter R **eg.** Joint no K 02 M 45 is repaired. Then this joint shall be renumbered as K 02 M 45R, Similarly if joint is cut Due to any reason that joint shall be suffixed by letters RW, **eg.** joint no K 09 M 20 RW.

If pup piece is added after cutting the joint shall be suffixed with letter A to preceding Joint and second joint shall be renumbered by suffixing a letter RW to cut joints. **Eg.** Joint no K 08 M32 is cut and pup piece is added in between, then newly welded joints shall be numbered as below,

1<sup>st</sup> Joint K 08 FT 31 A

2<sup>nd</sup> joint K 08 M 32 RW



### **Where pipe ends are cut :**

All pipe cutting including cutback, damaged bevel ends shall be reported and revised pipe numbers allocated to each cut pipe (pup). The revision takes the form of a suffix A, B, C etc **eg.** Pipe No 5003 cut into three pieces shall be denoted as 5003A, 5003B

and 5003C. The revised pups numbers shall be transferred inside & outside surface of the pups before cutting.

**illustration for welder numbers :**

A - C - E - G      ——— 12 — 9 - 6 Anti Clock position      Flow Direction  
 B - D - F - H      12 — 3 — 6 — 0 Clock position      —————→

Where A, B, C, D, E, F, G, H are respective welders ID numbers

Clock position shall be visualized with respect to flow direction.

All the numbers shall be written with yellow chalk facing towards ROW side and before offer to EIL inspection by yellow / white / red paint or marker pen. Such paint shall be to the satisfaction of client.

In case of any conflict between this procedure and that of above referred standards and specifications, provisions of the latter shall govern.

Note: The revised Pipe Nos., Heat No., Coating No. & Length shall be transferred on cut pup pieces.

**MAINLINE WELDING**

All work shall be carried out as per EIL specification, and after approval and qualification of the respective welding Consumable and Procedure. Before the fit up pipe shall be checked for correct thickness, specification and thoroughly examined for internally and externally for clearness and to ensure it is free from defect the pipe shall be adequately swabbed each length shall be pulled through just before alignment. Bevel

ends shall be visually checked, if any damages are found the same can be repaired as mentioned below:

- a. Damaged bevel less than 1mm depth shall be removed by grinding.
- b. Damaged bevel 1mm to 3mm depth shall be re- beveled by grinding.
- c. Depth more than 3mm shall be cut and re- beveled with an approved beveling machine.
- d. Any dent found more than permissible limit on pipe shall be removed by cutting appropriate length of pipe
- e. Before any pipe length is cut, the painted serial number and the heat number shall be transferred to the either side of the joint which is to be made by cutting and records shall be prepared.

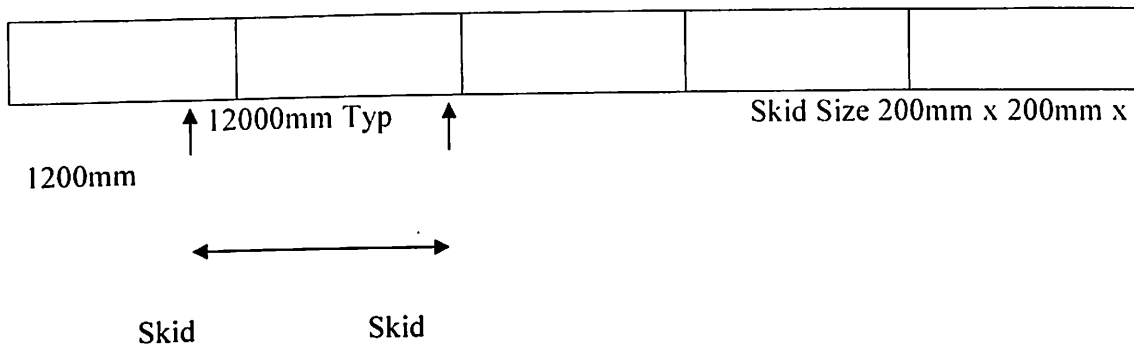
Manual cutting beveling and repairing of pipes by welding is not allowed.

If any laminations, split ends or any other manufacturing defects in the pipe be discovered, the length of the pipe shall be cut to the extent required with the knowledge of EIL/MBPL and a joint record shall be generated. Pipes which have been cut shall be checked by UT to an extent of 25mm at the new bevel to ensure it is free from laminations. The new bevel shall be 100% visual and DPT Checked Reports shall be prepared for all the above tests.

Before fit- up pipe ends inside/ outside shall be cleaned by power wire brush at least for 1" so that the welds are free from rust, paint and other foreign matters.

During alignment and fit- up first pipe will be rested and locked on the pre- positioned skids and the second pipe will be held by Side Boom with internal fit- up clamp (Pneumatic). The second pipe will be carefully lowered on pre- positioned skids. Skidding arrangement shall be shown below and skids may be removed only after completion of the entire welding joint numbering and the pipe shall be rested on the sand bags. The height of the support must be such that each weld is made at least 50 cm above the ground.

## Weld Joint



Since the longitudinal seam is spiral seam, it shall be staged 90 degree or 250 mm apart whichever is less. Maximum offset of the same nominal wall thickness pipe shall not be more than 1.6 mm, In case of slight misalignment; cold hammering is permissible only by brass hammer. Hot dressing is not permitted.

Where different wall thickness pipes are to be welded and the difference In wall thickness is more than 1.6mm then 1:4 taper internal grinding on the higher thickness shall be done. To match the I.D of lower wall thickness pipe.

Pipe number, heat number, coating number to be transferred on the surface the pipe and should be visible at the normal eye view.

Root gap shall be as per the approved WPS.

After alignment & fit- up pre-heating shall be carried out (as required in respective WPS) and the same shall be checked with thermo chalks/ temperature indicating pyrometer before starting the root run.

Earthing clamps used for welding return circuit shall only be placed on bevel area or cir. Welds. Earthing clamps to be properly placed to avoid earthing strikes. Any arc-strikes resulting there in shall be repaired as per approved procedure Arc strike & Arc burns may be checked by required NDT Method. No arc strike is permitted on pipe

Internal line- up clamps shall not be released before the root run is completed. In case of external clamps at least 60% of the root weld (between all spaces of the bars) shall be completed before releasing the clamp. For crack prevention a top & bottom reinforcement of at least one electrode shall be applied before lowering the pipe on the skid. Weld joints shall be protected from rains/ sand storms. Wind shield shall be used in the afore said conditions.

Pre- heating and inter pass temperature shall be done as per the approved WPS Procedure.

**Welding:**

Welding shall be carried out as per the approved WPS. Minimum No. of welders shall be two for mainline and Tie- In welding for each pass. Welder deployed shall be duly qualified and shall be carry ID Card at site.

**Weld Sequence:**

Welder No.1 shall start from 12 'O' Clock position and proceed towards 6 'O' Clock, Welder No.2 shall start from 9 'O' Clock position and proceed towards 6 'O' Clock and then from 12 'O' Clock to 9 'O' Clock. Proper Overlap shall be ensured.

After completing every pass, the same shall be cleaned/ flattened by grinding and power brushing.

Electrode starting & finishing points shall be staggered from pass to pass.

Interruption between Root pass to hot pass and to 1<sup>st</sup> filler shall be Maximum 4 Mins AS per the approved WPS. After completion of the third pass welding may be suspended if required, so as to allow the weld joint to cool down provided the thickness of the weld metal deposited shall be 50% of the pipe thickness or minimum of 03 passes whichever is more. Upon restarting the welding pre-heating shall be carried out as per the approved WPS.

Arc Strike outside the beveled area on the pipe surfaces is not permitted. Arc strike Any caused accidentally shall be removed by grinding and NDT check shall be carried out. Thickness after grinding shall not be less than permissible limit for the pipe.

Repair of arc strike by welding is not allowed.

Pipe should not be jumped or shaken during welding.

Welders shall be qualified as per the approved WPS and all the welders should have identity cards duly signed by EIL.

After completion of welding the joints are to be numbered as per approved procedure weld visual inspection shall be done and all the surface defects shall be removed as per the specification. NDT shall be carried out as per the approved NDT procedures. NDT repairs shall be done as per approved WPS.

Repair procedure to be qualified separately for full through thickness and partial. Thickness respectively. Only 01 attempt for repair is permitted. Root sealing or single pass repair shall not be allowed, Ensure no grinding marks are made anywhere on the pipe surface, Repairs are restricted to maximum 30% of the weld length.

Destructive testing of weld joints (Production Joints) shall be 0.1 % of the total number of welds .The test piece shall be cut min. 150mm on either side of the weld.

At the end of the day's work or every time when joining and welding operations are interrupted, the open ends shall be closed with nightcaps.

All measuring equipment and devices should have valid calibration certificates.

### **TIE-IN WELDING**

Tie-in fit up shall be preferably carried out at average ambient temperature to avoid variation in fit up gap due to contraction / expansion of the concerned pipe length, the tie-in shall be made by using external clamp in such way that joint shall be free from any excessive stress and tension. The necessary small displacement for perfect alignment shall be achieved during lowering of pipe section by providing sufficient overlap at unconnected ends. Bell holes with sufficient size shall be made to facilitate

for alignment welding and provide adequate clearance to the welders to make sound weld.

UT shall be checked on pipes which have been cut to an extent of 25mm at the new bevel to ensure it is free of lamination. The new bevel shall be 100 % DP/MPI tested. The reports shall be prepared for all above tests. Before any pipe length is cut the painted pipe no., heat no. shall be transferred to either side of pipe length.

Where different wall thickness pipe are to be welded & difference of wall thickness is more than 1.6 mm then 1:4 taper, internal grinding on the higher thickness shall be done. So as to match with I.D of lower wall thickness pipe.

Prior to start welding:-the fit up shall be thoroughly checked for proper root-cap, landing at bevel, mismatching and to ensure that uniform pre-heating is achieved. Two nos of welders are to be deploying for welding of tie-in joints, Welder shall carry their I.D card, External line up clamp shall be released only after 60% of root welding is completed.

Welded joints which are welded using external clamps (e.g. tie-ins welds) shall be 100% tested by ultrasonic & Radiography testing with X rays shall be carried out in accordance with the provisions of API 1104. Gamma rays may be allowed in case of inaccessible joints if permitted by EIL / MBPL.

Pipe pipe piece length for Tie- In shall be minimum 1M. Two or more pipe pieces shall not be welded together. In no case more than 3 Cir. Seam welds shall be permitted on 10 M length of pipe.

For Tie- In at already hydro-tested sections, the pre-tested pipe pieces shall be used.

The tie-in shall be deemed to be completed upon completion of all activities including cutting, beveling, fit up, welding, NDT clearance, cleaning, priming, coating, holiday test and back filling of the Tie-In portion, as per relevant procedures/ Specifications.

## **RADIOGRAPHY**

Radiography shall be carried out using the following Techniques with X-Ray Radiation.

**a) SINGLE WALL SINGLE IMAGE :**

This Technique is ideal for pipeline mainline joints. In this technique the radiation penetrates through single wall of test Object & image of the single wall is recorded on the Radiograph. In the case of Pipelines the Radiography Equipment with Panoramic X-ray source fitted with a Crawler, is placed at the Center of the Pipeline.

**b) DOUBLE WALL SINGLE IMAGE :**

This Technique is ideal for pipeline tie-in joints. Here the Single wall single image is not possible. In this technique the Radiation penetrates through both the walls of test object and Single image of the test object closest to the film is recorded on the Radiograph.

**PLACEMENT OF MARKER AND I.Q.I.**

Lead markers shall be kept to identify the test Object, Date of Radiography, area of interest of the object, the location of the Radiographs and any other information as specified by the client.

For DWSI, I.Q.I. shall be placed approximately 30mm away from the location marker such that the thinnest wire of the DIN type penetrameter shall be far most from the source. In case of Panoramic Exposure Techniques, 4 nos. IQI's shall be placed equidistant along the circumference. During procedure qualification, IQI shall be placed both on source side and on Film side.

**FOCUS TO FILM DISTANCE :**

Focus to Film distance shall be such that the geometrical un sharpness ( $U_g$ ) shall be as per the chart below.

**Material thickness (inches)**

**$U_g$  Maximum**

|                |       |
|----------------|-------|
| Under 2        | 0.020 |
| 2 to 3         | 0.030 |
| over 3 to 4    | 0.040 |
| Greater than 4 | 0.070 |

The  $U_g$  is determined by

$$U_g = Fd/D$$

Where  $U_g$  – geometrical un sharpness

F – Focal spot the maximum projected dimension facing perpendicular to  
Film center.

D- Distance from focus of radiation to the specimen being radio graphed.

(F.F.D.)

d- Distance from source side of the specimen to the film (thickness)

### **EXPOSURE TIME :**

Exposure time shall be calculated with penetrated wall thickness, F.F.D. and film speed using Exposure chart.

### **FILM LOADING:**

Film shall be loaded in the dark room under proper safe light, Filter. Films shall be cut carefully without any damages, scratches or finger marks. Sandwich the film between pair of screens & loaded into tight PVC cassettes or holders.

### **NUMBER OF EXPOSURES:**

The number of Exposures will be such that the area of Interest is completely covered and when multiple films are used the overlap between any 2 films will be a minimum of 40mm. Minimum one exposure shall be taken for Single Image and four exposures for Double Wall single Image technique for Pipeline joints.

#### **FILM PROCESSING:**

Film shall be process in a dark room under safe light. The temperature of the chemical shall be  $20^{\circ}\text{C} \pm 1^{\circ}\text{C}$  or as specified. The film shall be unloaded in hangers/ spools care fully to avoid any marks.

The manual processing involves the following steps.

All the steps shall be performed on a test film initially to determine any effect of processing.

##### **Step: 1**

**Developer:** Shake the hangers or spools to avoid any uneven developing marks. Developing time shall be as recommended by film manufacturer varies from min. 3 to 8 minutes for class II films.

##### **Step: 2**

**Stop bath:** The stop bath is water with 5 to 6 drops of acetic acid per gallon of water. To arrest developing action, films are immersed in a stop bath. Shake hangers/spools for 2 to 3 minutes in the stop

##### **Step: 3**

**Fixer:** To remove the excess silver grains from unexposed or less exposed part of film & to harden base of film, the hangers/spools shall be immersed in fixer for at least 10 minutes.

##### **Step: 4**

**Running water:** Films shall be kept in running water tank where excess fixer will be washed from the surface of the film. Wash at least for 30 minutes.

**Step: 5**

**Drying:** Films shall be dried in open space or in dryer with circulating hot air less than 55°C.

**FILM VIEWING:**

The films shall be viewed under a high intensity Film Viewer capable of reading radiographs of Density up to 4 & with adjustable light intensity. Viewing shall be done under subdued background lighting of an intensity that will not cause troublesome reflection.

**FILM DENSITY**

To measure the film density, a calibrated densitometer should be used.

Film density shall be between 2 and 3.5 or as specified.

**FILM CONTRAST:**

Contrast of the film shall be adequate to manifest on the Radiograph even the smallest thickness differential. Better the contrast; better the visibility of discontinuity during interpretation.

**SENSITIVITY:**

The film sensitivity shall be better than 2 % & shall be confirmed by computing or in accordance with ASME Section V, Article 2, and Table 276 equivalent wire size, in case of X-Ray Radiography.

**INTERPRETATION :**

All indications that are equal to or greater than rejection level described in acceptance / rejection criteria of API 1104 or as agreed by client's inspector shall be considered representing defects and may be cause of rejection or repair of the weld or base metal. All Radiographs showing film marks in the area of interest shall be reshot in accordance with this procedure.

**ACCEPTANCE OR REJECTION CRITERIA:**

Acceptance or rejection criteria shall be in accordance with API 1104 and as specified in EIL specification. All defect location shall be marked & recorded for repairing.

**RE-TEST:**

Retest of the repaired area shall be carried out in accordance with this procedure.

**FILM STORAGE & ARCHIVE LIFE:**

Films shall be stored in dry place with humidity less than 80% in proper storage boxes with identification. Methylene blue test shall be carried out to find out its archive life.

The radiographs shall be processed to allow storage of films without any discoloration for at least 3 years.

**ULTRASONIC TESTING**

Unless otherwise specified, inspect the weld on both sides by using longitudinal & shear wave probes.

- **LONGITUDINAL WAVE PROBE :**

With reference to first back wall echo 80% + 5%, Scanning shall be carried out before and after weld on base metal to confirm any inherent or after weld discontinuity. During scanning with longitudinal wave probe, full contact and echo height shall be maintained. Area of scanning shall be at least ½ Beam Path to 1 ½ Beam path on the both side of pipe weld. This scanning will reveal discontinuity with major surface parallel to scanning surface.

- **SHEAR WAVE PROBE :**

With respect to DAC, Scanning shall be carried out on both sides of weld to determine discontinuity within the weld & base metal, which are not parallel to scanning surface, Both the probes be scanned individually on both the sides. Scanning shall cover at least ½ Beam Path to 1 ½ Beam Path of beam path. Unless & otherwise specified, circumferential direction scanning shall be carried out on base metal.

**1. PERIODIC CHECK OF SCREEN CALIBRATION :**

Calibration of screen shall be checked prior to any inspection run, prior to equipment shut down and at least in each 4 hours during continuous equipment operation.

**2. INTERPRETATION OF RESULTS :**

All indications that are equal to or greater than rejection level, established during calibration, as described in acceptance / rejection criteria in section 15 of this procedure

or agreed by client's inspector, shall be considered representing defects and may be cause of rejection repair of the weld or base metal.

### **3. ACCEPTANCE OR REJECTION CRITERIA :**

Acceptance or rejection criteria shall be in accordance with API 1104 or as per specified in client's specification. All defect location shall be Recorded & / or Marked for repairing.

### **4. RETEST:**

Retest of the repaired area shall be carried out in accordance this procedure.

## **FIELD JOINT COATING**

### **Equipment**

1. Sand blasting sand for Surface Preparation,
2. Sand blasting hopper,
3. Air compressor with moisture separator,
4. Sand Blasting Gun
5. LPG Burners, hose & LPG Cylinders,

Incase the authority having jurisdiction have no objection, the contractor may adopt sand blasting instead of shot/ garnet material.

### **Materials**

1. Heat Shrinkable Sleeves (Raychem Make) Type: HTLP-80 (Confirming to EN 12068-C HT600UV.)
2. Epoxy Bulk Kit. ( Raychem Make )
3. Applicator Pad with mixing cup & stick (1 per joint). ( Raychem Make )
4. Polyethylene Repair Patch (Perp). ( Raychem Make )
5. Straight Silicone Roller/Curved Silicon Roller.

### **Measuring and Test Equipment**

- a) Peel Gauge Tester.
- b) Temperature Sticks/Pyrometer.
- c) Holiday Detector.( Spy make )
- d) Hygrometer
- e) Coatmeter
- f) Wet film thickness guge
- g) Roughness profile measuring (Stylue) instrument.

All measuring and test Equipment shall be calibrated and shall have valid calibration certificate.

### **Field Joint Coating**

#### **a) Surface Preparation**

Uncoated steel surface and adjacent line coating (100 mm) shall be free from oil, grease, salts and other contamination. All weld spatter, flux and scale shall be removed. Suitable solvent, which does not leave any insiduals like benzene, xylem or equivalent, shall be used. Kerosene shall not be used for cleaning.

Prior to surface cleaning, the surface shall be completely dry. During blast cleaning, the pipe surface temperature shall be simultaneously more than 5°C and more than 3°C above ambient DEW point, while ambient temperature, relative humidity shall be not >85%. Uncoated steel surface shall then be sandblast cleaned to a finish equivalent to SA 2.1/2 of Swedish Standard SIS-055900 and have profile of 50 - 70 microns. Roughness shall be checked by roughness profile measuring ( stylus ) instrument. The roughness profile shall be 50-70 microns. White latex paint if any, on the line coating shall be removed (100 mm) by gentle sand blasting. The blast cleanliness shall be checked on every joint & roughness profile check shall one every 10 joints. Dust, grit or foreign matter shall be removed from cleared surface by suitable industrial vacuum cleaner. The dust contamination allowed shall be of a rating maximum 2 as per

ISO8502-3: The frequency of checking shall be 1 in 10 joints. Blast cleaned field joint shall be coated with in 2-4 hours according to the conditions below.

RH>80% - 2 Hours.

RH=70-80% - 3 Hours.

RH<70% - 4 Hours.

The Field joint surface shall be inspected immediately after blasting, cleaning and any imperfection on steel surface like spatter, scale, lamination etc. which is injurious to the coatings shall be reported to EIL/MBPL and on permission such defects shall be removed by file or grinding. Pipe effected in this area shall be NDT checked, thickness of ground area shall be measured and re-blast, clean if as required.

The ends of existing pipe protective coating shall be inspected and chamfered at an angle of 30° or less prior to application. Unbounded portion of the coating shall be removed and than suitably trimmed portions where parent coating is removed shall also be prepared as mentioned above. Joint coating shall be done immediately after completion of surface preparation.

#### c) Application of Heat Shrink Sleeve

The application of heat shrink sleeve shall be as per the recommendation of the manufacturer. Before installing the wraparound sleeve, the bare steel surface shall be pre heated over the surface at a temperature recommended by manufacture and shall be checked by contact type temperature recording thermometer. The solvent free epoxy primer shall be mixed and applied prior to sleeve application as per manufacture's recommendations. The wet film thickness to be checked with film thickness gauge. The gauge to be calibrated once per shift. The sleeve shall install immediately after epoxy application but not later than the drying time of epoxy.

The HSS Raychem HTPL-80 or approved equivalent shall be wrapped loosely around pipe, centering it over the weld area and evenly overlapping the adjacent pipe coating in a cigarette fashion.

The LPG gas torch is adjusted to have a bushy yellow flame of approximately 50 cm. Using the yellow portion the flame the closure backing is evenly heated until the pattern of the fabric reinforcement is visible.

A minimum overlap of 50 mm is to be ensured (after shrinking). In case where carrier pipe is installed by boring. The overlap of coating for leading edges joints shall be min. 200 mm. where this overlap is activated by providing additional patch, it shall be applied in such way surface edge of the patch is in direction opposite to direction of boring. The sleeve is so wrapped that closure patch is positioned to one side of the pipe in 2' O clock or 10' O clock position. The closure patch is pressed in position centering over the exposed sheet end. Overlap between the sleeve and closure patch shall be minimum 100 mm.

The closure backing is patted down with gloved hands and gently working them outwards from the center of the closure. This eliminates possible entrapped air and ensures good bonding. For this purpose the small hand roller will be run over the closure backing.

Using the LPG gas torch, beginnings at the center of sleeve heat circumferentially around the pipe, using a constant paint brush motion.

During shrink down, an occasional check of adhesive flow with finger will be made. Wrinkles should disappear automatically.

When the sleeve has been shrunk on to the joint area and is still hot and soft, a small hand roller shall be run over the same to push out any trapped air, particularly attention to be paid to the weld and cut back area and if necessary the areas may be reheated to roll out air.

The sleeve is fully recovered when all the following have occurred:

- a) The sleeve has fully conformed to the pipe and adjacent coating.
- b) There are no cold spots or dimples on the sleeve surface.
- c) Weld bead profile can be seen through the sleeve.
- d) After sleeve is cool adhesive flow is evident on both the edges.

If there is air trapped, hand roller will be used to remove it. In case of unacceptable installation, the sleeve shall be removed and replaced in accordance as specified above. KPTL to pre-qualify the field joint coating system proposed above 5 joints to be coated with requirement of the specification, inspected & tested in the presence of vendor representative to be approved by Engineer- In- Charge.

### **Repair of Coating**

For field repair of coating defects which have been caused during transportation from Dump site to Right-of way or during handling/stringing operations the following repair procedure will be adopted. All coated pipes with damage to coating will be repaired using the RAYCHEM PERP system.

All loose coating to be removed, trimmed and chamfered, cleaned of any soil, grease etc. and area roughened with abrasive paper. 'PERP' repair patch to be cut 50mm larger than chamfered area so that it extends all around area to be repaired.

Preheat repair area and adjacent pipe coating to 60 deg. C and apply PERP FILLER MASTIC which has been cut of size. Heat the mastic with care and smooth with trowel/scrapper. Flame brush adhesive side of PERP repair patch. Heat application shall be as per manufacturer recommendation. Complete the installation by smoothening with a gloved hand or roller.

Max. size of PERP patch application shall be limited to manufacturer recommendation and if the repair area is more than the recommended PERP application then repair will be done by heat shrinkable sleeves type HTLP60 M/s RAY-CHEM.

### **Inspection and Tests**

A visual inspection for sign of punctures, dents or air entrapment etc. shall be carried out. Weld bead profile shall be visible through the sleeve. Pattern of fiber reinforcement shall be visible through the sleeve. Pattern of fiber reinforcement shall be visible on the closure patch. Mastic extrusion on either of the sleeve shall be examined.

### **Holiday Detector**

The holiday detector used shall be checked and calibrated daily with an accurate DC voltmeter. The holiday detector shall be used with a full circle spring to detect pinholes etc., on the entire surface of joint coat section. The detector shall be set a DC voltage of 25KV. Holiday check to be carried out after the joint has been cooled below 50 ° C.

### **Peel Test**

Peel test shall be carried out on one of every 50 joint coating or one joint coating out of every day's production.

From each test sleeve, strip of size 25 mm x 200 mm shall be cut perpendicular to pipe axis and slowly peeled off. The required peel strength shall be as per table below and after removal of strip, the adhesive layer that remains on the pipe surface shall be essentially free of voids. KPTL shall undertake repair/replacement of all defects/defective coatings.

The required peel strength shall meet the requirements of clause 3.2.2 (EIL Spec.) as applicable for 23 degree C or 60 degree C whichever is feasible. After removal of strip the bulk of adhesive shall remain adhered to the pipe showing no bare metal, otherwise, test shall be considered failed.

The adhesive layer that remains on the pipe surface shall be free from voids resulting from air and gas inclusion. Repair shall be carried out with Perp as per Joint Coating Repair Procedure

If the sleeve taken away for peel test does not meet the requirement as stated above, adjacent two sleeves shall be tested. If the adjacent two sleeves are acceptable the test rate shall be increased to one sleeve for every twenty-five until EIL is satisfied. If either or both the sleeves do not meet the requirements mentioned above, the field coating shall be stopped for investigation.

### **Thickness Measurement**

The thickness of field joint coating materials shall be such that an average thickness of 2.0 mm & Min.1.8 mm is guaranteed on the completed field joint coating. The minimum permissible thickness at the apex of weld seam shall be 1.6mm.

### **LOWERING**

Lowering shall start only after obtaining approval from EIL/MBPL in part "A" of Pipe Book. Entire trench bottom shall be checked to remove the presence of all cuts, pipe supports, stones, roots, debris, stakes, rock projections up to 15 cm below underside of pipe and any other rigid materials which could lead to perforation/ tearing of the coating.

Soil/Sand padding shall be done at all places where rock, gravel or hard soil is encountered. The completed thickness of the padding shall be at least 300 mm all around the pipe. Initially a compacted layer of 300 mm shall be spread in the trench before lowering. Subsequent padding shall be done after lowering. Before start of pipe lowering, OFC laying shall be completed with sand padding and protective mat.

Lowering shall follow as soon as possible, after the completion of joint coating of the pipeline. A complete check by a full circle holiday detector, duly calibrated, for pipe coating and for field joint coating shall be carried out at 25KVA and damages, if any, and shall be repaired. All points on the pipeline where the coating has been in contact with either the skids or with the lifting equipment during laying, shall be carefully

inspected for damages, denting or other defects and shall be completely repaired. If, after checking, it becomes necessary to place the pipeline again on supports at the bottom of the trench, these must be padded in such a way as to prevent damage to the coating, thus avoiding necessity for further repairs when the pipe is finally raised and laid.

## **BACKFILLING**

Backfilling is to be commenced only after post padding is done at least for 300 mm above the pipe. Backfilling shall not be done until the pipe and appurtenances have been properly fitted and the pipe is according to the ditch profile at the required depth that will provide the required cover and it is not riding upon any stone, hard core etc., and has a bed which is free of extraneous material and which allows the pipe to rest smoothly and evenly. De-watering if required will be carried out; in general trench should be dry prior to padding. The last 3 or 4 pipe lengths shall not be backfilling at both ends to facilitate tie-ins of the lowered sections.

Before start of backfilling we shall ensure the provision of anti-buoyancy measures.

The backfill material shall be soil, sand, clay or other materials containing no materials, which could damage the pipe and/or coating or leave voids in the backfilled trench. Each completed layer of backfilling shall be carefully deposited, watered where necessary and thoroughly consolidated. The surplus material shall be neatly crowned directly over the trench and the adjacent excavated areas on both sides of the trench to such a height, which will, provide for future settlement of the trench backfill during the maintenance period and thereafter. The crown shall be high enough to prevent the formation of the depression in the soil when backfill has settled into its permanent position.

Should depression occur after backfill, we carry out the remedial work. Surplus material left from this operation shall be disposed off to the satisfaction of landowner or authority having jurisdiction.

When the trench has been dug through driveways or roads, all backfilling shall be executed with sand or suitable materials (shall be approved by EIL) in suitable layers, which will be thoroughly compacted. Compaction tests shall be carried out to ensure proper compaction and avoid future settlement.

At the end of each day's work, maintain the backfill against washouts etc., until the completion and final acceptance of the work.

Back filling in steep areas where slope is 10% or more shall be provided with breakers. These breakers will consist of grout bags filled with 4:1 sand: Portland cement.

We shall arrange to take levels as soon as the lowering activity is completed in to allow survey the centre line of the pipe and the level of pipeline in the trench prior to backfilling. We shall replace the top soil wherever applicable, which was stored separately during trenching slope & soil stabilization to be carried out as per relevant specification & at locations shown in alignment sheets.

For U/G pipeline crossings & overhead power line crossings concrete slab 100mm thick or plastic grating 6mm thick to be provided.

### **MAJOR RIVER CROSSINGS**

A pre-construction survey shall be carried out by the contractor to collect the required data like water velocity, and the tidal variations in the flow pattern and shall verify the suitability of equipment and the method of construction.

A detailed scheme should be submitted including levels of the riverbeds for the proposed method to be adopted for installing the pipeline in the river.

All works of the pipeline river crossings shall be performed in accordance with the approved construction drawings, procedure and other applicable documents. Water permission to be obtained from authority prior to start the work.

We shall not hamper the users of the roads, railroads, buried services and/or watercourses. The water flow shall not be obstructed in any way. We shall pay special attention to minimize any damage to embankments and dikes in the vicinity of water crossings.

The equipment for launching shall be arranged in a manner such that the pipeline is laid without impact or jerking and is not subjected to stresses of any type. The work under crossings shall include necessary clearing, grading and trenching to required depths and

widths, concrete coating, Hydrostatic pre testing, welding, coating, lowering-in, backfilling, gauging, post hydro testing clean-up, restoration to the original condition.

Before starting the installation work of crossings, we shall provide suitable barricades, temporary bridge/bypass work with railing, if required for safety of traffic. Adequate traffic warning signals and/or traffic lights and suitable diversions shall be provided.

Trenching shall be executed as accurately as possible, as per approved drawings.

We shall make cross profiles at intervals of not more than 10.0m of the bottom of the water course along the surveyed centreline of the water crossing. The cross profile shall be extended at least 10m on both sides of the top of the trench. KPTL to submit reference profile with respect to elevation of undisturbed water course plotted on a 1:200 scale.

In case of crossings for which no special methods of laying are required, a pipe section of a size as per the approved drawings shall be assembled and subsequently laid. Bends shall be of cold field type. coat the weld joints in order in arrive at continuously concrete coated pipe line after pre hydro test.

The depth of the existing bottom of river crossing shall be determined in relation to the adjacent ground level by taking the average of four measurements. In case off submerged sections where rock or gravel is encountered at the bottom of trench 500mm padding is to be provided.

The minimum cover of the pipe shall be as specified in the specification and standard drawings issued for the purpose. The dredging work shall be done in accordance with spec.

The pipe section shall be made in such a way that it conforms to the riverbed profile as indicated in the approved drawings. The max unsupported span shall not more than 10m.

The max allowed horizontal deviation from the required centreline shall be limited 500mm.

Sufficient soft soil shall be backfilled initially around and over the pipe whenever boulders or hard rock are confronted to provide a protective padding or cushion

extending to a minimum thickness of 25 cms around the pipe before backfilling remainder of the trench with excavated or other material.

For open cut crossing the bottom of the trench shall be graded for at least 12 m at the approach at each end and if necessary backfilled with soft soil to provide a continuous support so that pipeline is correctly aligned at casting ends during and after backfilling.

Pipeline crossing shall be hydrostatically protested as per approved procedure. The test pressure shall be EIL spec.

The section of pipeline shall be tested as a single string. The pressure shall be retained for minimum of 24 hours after stabilization. Test section shall be examined visually for leaks and rel.

Trenches in banks of major water crossings shall be backfilled with soil. The fill at the banks shall be tamped firmly and reinforced with sacked earth, riprap or by other means. Bank protection works shall be carried out in accordance with the drawing and specification.

Final hydrostatic testing for 4 hours, posts construction survey and final cleanup shall be done.

The NOC from the authority is to be submitted after the works.

## **5. RESULT AND DISCUSSION**

Often there is argument presented that higher test pressures exceeding 100% of the SMYS will increase the “strength” of the material and will “stress relieve” the material. Both arguments have no technical basis to the point they are made. We will briefly discuss both these arguments here:

1. Higher test pressure will “increase the strength.” As the material is stressed beyond its yield point, the material is in plastic deformation stage, which is a ductile stage, and hence it is in the constant process of losing its ability to withstand any further stress. So, it is not increasing in strength but progressively losing its strength.

2. The second argument of “stress relieving” is linked with the “increase the strength” argument. The stress relief of material is carried out to reduce the locked-in stresses. The process reorients the grains disturbed often by cold working or welding. The stress relief process effectively reduces the yield strength. Thus, it does not “strengthen” the material. Note: It may be pointed out that a limited relaxation of stresses does occur by hydro testing, but the test pressure should be less than the material’s yield point.

## **6. CONCLUSION**

This presentation has shown the technological benefits of hydrostatic testing as a means of integrity assurance for pipelines. A well-proven model has been used to show that those benefits are quantifiable. The economic issues of hydrostatic testing are extremely important and will determine whether or not hydrostatic testing can be used on any given pipeline. For those operators who will be able to use hydrostatic testing, this presentation offers some useful guidelines to help the operator optimize confidence in the test as a means of integrity assurance.

## **7. REFERENCES**

- HMPL-technical tender documents
- API 1104 – standard for welding pipeline and related facilities.
- ASME B31.4 – Pipeline Transportation systems for Liquid Hydrocarbons