10.0 WELDING

10.1 Root Pass

a) The root pass shall be made with the electrodes/filler wires recommended in the welding specification chart attached along with the other project data sheets. The size of the electrodes used shall be as per the approved welding procedure.

b) Position or roll welding may be permitted. The vertical up method of welding shall be used for the root pass of the tie-ins, special crossings, fittings and special parts, fillet welds, repairs and when an external line up clamp is used. The downhill welding may be used for the root run welding of tie-ins and special crossings when (a) the edges are machined or have equivalent preparation (b) line up clamps are used and the fit up is geometrically and mechanically similar to one of the ordinary line welding without misalignment or unevenness.

c) The root pass of butt joints shall be executed properly so as to achieve full penetration with complete fusion of the root edges. Weld projection inside the pipe shall not exceed 3 mm wherever not specified by the applicable code.

d) Any deviations desired from the recommended welding technique and electrodes indicated in the welding specification chart shall be adopted only after obtaining express approval of the COMPANY.

e) Welding shall be continuous and uninterrupted during a pass.

f) On completion of each run, craters, welding irregularities, slag etc., shall be removed by grinding and chiseling.

g) While the welding is in progress care shall be taken to avoid any kind of movement of the components, shocks, vibration and stresses to prevent occurrence of weld cracks.

h) Fillet welds shall be made by shielded metal arc welding process irrespective of the thickness and class of piping. Electrode size shall not exceed 3.25 mm diameter for the socket joints. At least two passes shall be made on the socket weld joints.

i) Peening shall not be used.

10.2 Joint Completion

In case of manual welding, for sizes 12” and above, the first pass shall be carried out by a minimum of two welders, working simultaneously and so placed as to cause minimum distortion of the pipe.

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The number of welders and the allowable welding sequences shall be as those laid down in the qualified welding procedure specification. Once the deposit of the first pass has been started, it must be completed as rapidly as possible, reducing interruptions to the minimum. The welding and wire speed shall be approximately same as that established in the qualified welding procedure specification.

The pipe shall always be adequately supported and must not be bumped or shaken during welding. The clamp shall be removed, as indicated in clause 8.0 above. Before starting the second pass, the first pass shall be cleaned and flattened with rotating grinders.

The interruption between completion of the first pass and starting the second pass shall be as stated in the procedure specification, normally not exceeding four minutes.

For crack prevention a top and bottom reinforcement of at least one electrode shall be applied before lowering the pipe on the skid.

The welding speed selected shall enable production of a bead which is sufficiently thick and which shows no under cutting.

The time lapse between the second and the third pass shall be as stated in the procedure specification, normally not exceeding five minutes. After completion of the third or following passes, welding operations may be suspended, so allowing the joint to cool down, provided that the thickness of the weld metal deposited is equal to at least 50% of the pipe thickness. Upon restarting, depending on the materials, wall thickness and welding process, a preheating of at least 100°C shall be applied. Subsequerit passes up to weld completion shall be protected to avoid rapid cooling, if meteorological conditions so dictate. Cleaning between the passes shall be done carefully so as to reduce the possibility of inclusions.

The electrode starting and finishing points shall be staggered from pass to pass. Arc-strikes outside the bevel on the pipe surface are not permitted. Arc-strike or arc-burn on the pipe surface outside the weld, which are caused accidentally by electrical arcs between the electrode, electrode holder, welding cable or welding cable round and the pipe shall be removed by grinding in accordance with a procedure approved by the COMPANY and the repair checked by ultrasonic, radiographic, magnetic particle or dye penetrant tests which the COMPANY feels

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necessary. The pipe wall thickness after grinding shall not be less than the minimum thickness limit permitted for the pipe. Repair of arc strikes by welding is prohibited.

The completed weld shall be carefully brushed and cleaned and shall appear free from spatters, scales, etc.
These requirements apply not only to completed welds but also to the bare strip at least so wide as to allow full skid examination at both ends of the pipe to allow a good ultrasonic inspection when it is required.

11.0 HEAT TREATMENT

11.1 Preheating

a) Preheating requirements for the various materials shall be as per the welding Specification chart attached along with other project data sheets.
b) Preheating shall be performed using resistance or induction heating methods. Pre-heating for tie-in welds, repair welds or welds at point spreads may be done using a propane gas burner ring with prior approval from PMC/owner. The contractor may be asked to demonstrate the effectiveness of the arrangement.
c) Preheating shall extend uniformly to at least three times the thickness of the joint, but not less than 50 mm, on both sides of the weld.
d) Preheating temperature shall be maintained over the whole length of the joint during welding. Temperature indicating crayons or other temperature indicating devices shall be provided by the CONTRACTOR to check the temperature.

11.2 Post Weld Heat Treatment

a) Post weld heat treatment, wherever required for joints between pipes and fittings, pipe body and supports shall be carried out by the CONTRACTOR at his expense as per the relevant specifications, applicable standards and the instructions of the COMPANY.
b) The heat treatment of welded joints shall be carried out as per the requirements laid down in ASME B31.8 and other special requirements mentioned in welding
Specification chart.
c) The CONTRACTOR shall submit for the approval of the COMPANY, well before Carrying out actual heat treatments the details of the post weld heat treatment Procedure, as per Exhibit 'B' attached, that he proposes to adopt for each of the Materials/assembly/part involved.
d) Post weld heat treatment shall be done in a furnace or by using an electric resistance or induction heating equipment, as decided by the COMPANY.

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e) While carrying out local post weld heat treatment, technique of application of heat must ensure uniform temperature attainment at all points of the portion being heat- treated. Care shall be taken to ensure that width of heated band over which specified post weld heat treatment temperature is attained is at least as that specified in the relevant applicable standards/codes.

f) The width of the heated band centered on the weld shall at least be equal to the width of weld plus 2" (50 mm). The temperature gradient shall be such that the length of the material on each side of the weld, at a temperature exceeding half the heat treatment temperature, is at least 2.5 rt where r is the bore radius and t is the pipe thickness at the weld.

g) Throughout the cycle of heat treatment, the portion outside the heat band shall be suitably wrapped under insulation so as to avoid any harmful temperature gradient at the exposed surface of pipe. For this purpose, temperature at the exposed surface of the pipe shall not be allowed to exceed 400°C.

h) The temperature attained by the portion under heat treatment shall be recorded by means of thermocouple pyrometers. Adequate number of thermocouples shall be attached to the pipe directly at equally spaced locations along the periphery of the pipe joint. The minimum number of thermocouples attached per joint shall be 2 up to 10" dia and 3 for 12" dia and above. However, the COMPANY can increase the required minimum number of thermocouples to be attached if found necessary.

i) Automatic temperature recorders, which have been suitably calibrated, shall be Employed. The calibration chart of each recorder shall be submitted to the COMPANY prior to starting the heat treatment operation and its approval shall be Obtained.

j) Immediately on completion of the heat treatment, the post weld heat treatment charts/records along with the hardness test results on the weld joints (whenever required as per the welding specification chart) shall be submitted to COMPANY for its approval.

k) Each joint shall bear an identification number, which shall be maintained in the piping sketch to be prepared by the CONTRACTOR. The joint identification number shall appear on the corresponding post weld heat treatment charts. The same identification numbers shall also be followed for identification of corresponding radiographic films. The chart containing the identification number and the piping sketch shall be submitted to the COMPANY in suitable folders.

l) Vickers hardness/Brinel hardness of the heat affected zone as well as of the weld metal, after heat treatment shall be measured using a suitable hardness tester and shall not exceed the maximum hardness specified in the welding

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specification chart. The weld joint shall be subjected to reheat treatment, when hardness measured exceeds the specified limit, at the CONTRACTOR'S own expense.

m) The CONTRACTOR shall arrange for the hardness testing and shall maintain the Records of all the joints tested. These records shall be checked by the plant COMPANY'S inspector.

12.0 INSPECTION & TESTING

12.1 General

a) The COMPANY'S Inspector shall have free access to all the concerned areas, where the actual work is being performed. The CONTRACTOR shall also afford the COMPANY'S inspector all means and facilities necessary to carry out inspection.

b) The COMPANY is entitled to depute its own inspector to the shop or field where prefabrication and erection of pipelines are being done, with (but not limited to) the following objectives:

   i) To check the conformance to relevant standards and suitability of various Welding equipment and the welding performance.

   ii) To supervise the welding procedure qualification.

   iii) To supervise the welders' performance qualification.

   iv) To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice followed in pipe construction.

c) CONTRACTOR shall intimate sufficiently in advance the commencement of the Qualification tests, welding works and acceptance tests, to enable the COMPANY'S inspector to be present to supervise them.

12.2 Welding Procedure Qualification

a) Welding procedure qualification shall be carried out in accordance with the relevant requirements of API 1104 latest edition (edition in force at the time of floating the enquiry) or other applicable codes and other job requirements by the CONTRACTOR at his expense. The CONTRACTOR shall submit the welding procedure specifications in format as per Exhibit-C (attached) immediately after the receipt of the order.

b) COMPANY'S inspector will review, check and approve the welding procedure submitted and shall release the procedure for procedure qualification tests. The. Procedure qualification test shall be carried out by the CONTRACTOR under field conditions at his own expense. A complete set of the test results in format as per Exhibit-C (attached) shall be submitted to the COMPANY'S Inspector for approval immediately after completing the procedure qualification test and at least 2 weeks before the commencement of actual work. Standard tests as

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specified in the code shall be carried out in all cases. In addition to these tests, other tests like radiography, macro/micro examination, hardness tests, dye penetrant examination, charpy v-notch etc. shall be carried out on the specimens. It shall be the responsibility of the CONTRACTOR to carry out all the tests required to the satisfaction of the COMP ANY'S Inspector. The destructive testing of welded joints shall be as per Annexure - 1.

12.3 Welder's Qualification

a) Welders shall be qualified in accordance with the API 1104 and other applicable specifications by the CONTRACTOR at his expense. The butt weld test pieces of the qualification test shall meet the radiographic test requirements specified in Clause 12.5 and Annexure-3 of this specification. The COMPANY'S inspector shall witness the test and certify the qualification of each welder separately. Only those welders who have been approved by the COMPANY'S inspector shall be employed for welding. CONTRACTOR shall submit the welder qualification test reports in the standard format as shown in Exhibit - D and obtain express approval, before commencement of the work. It shall be the responsibility of CONTRACTOR to carry out qualification tests of welders.

b) The welders shall always have in their possession the identification card as shown in Exhibit-E and shall produce it on demand by the COMPANY'S Inspector. It shall be the responsibility of the CONTRACTOR to issue the identity cards after the COMPANY has duly certified it.

c) No welder shall be permitted to work without the possession of identity card.

d) If a welder is found to perform a type of welding or in a position for which he is not qualified, he shall be debarred from doing any further work. All welds performed by an unqualified welder shall be cut and redone by a qualified welder at the expense of the CONTRACTOR.

12.4 Visual Inspection

COMP ANY shall carry out inspection of all welds as per the latest editions of the applicable codes and specifications. All finished welds shall be visually inspected for parallel and axial alignment of the work, excessive reinforcement, concavity, shrinkage, cracks, under-cuts, dimensions, surface porosity and other surface defects. Undercutting adjacent to the completed weld shall not exceed the limits specified in the applicable standard I code.

12.5 Non Destructive Examination

The non-destructive examination shall mainly consist of examination using x-ray radiography as detailed in Annexure 3.

Radiographic examination of one hundred percent (100%) girth welds will be required by the COMPANY. Welds shall meet the standards of acceptability as set forth in API 1104 and as well as the requirements laid in subsequent paragraphs.

The CONTRACTOR shall make all the arrangements for the radiographic examination of work covered by the specification at his expense.

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The COMPANY will review all the radiographs of welds and inform the CONTRACTOR regarding unacceptable welds. The decision of the COMPANY shall be final and binding in this regard.

All the requirements mentioned in the specification shall be arranged and executed by the CONTRACTOR through his own resources. In addition, ultrasonic inspection is required in the following cases as per Annexure - 2 of this Specification.

a) When 20 mm or more are cut from the pipe end as supplied, the ends shall be ultrasonically inspected for an additional length of 20 mm to assure no laminations exist.

b) When in the opinion of COMPANY, ultrasonic inspection is required to confirm or clarify defects indicated by radiography.

c) When automatic procedure is used at least 10 cm on each weld shall be ultrasonically inspected at COMPANY's discretion.

d) UT on Golden Joints.

e) 100 % UT shall carried out at the repaired area externally.

f) Single pass repair shall be subjected to 100% DP/MPT

All fillet and groove welds other than those radiographed shall be subjected to dye penetrant/ MP inspection. The non- destructive test system used for inspecting welds must be approved by the COMPANY.

12.5.1 Acceptance Criteria

Weld quality as judged on the basis of the acceptability criteria mentioned below:

i) Any weld, which as a result of radiographic and/or ultrasonic examination in the opinion of COMPANY exhibits imperfections greater than the limits, stated in API 1104 latest edition or as superseded in this article shall be considered defective and shall so be marked with an identification point marker.

ii) In addition to the API 1104 requirements, the welds containing cracks including crater cracks regardless of size or location, burn through, start crack and incomplete fusion, lack of root penetration are unacceptable.

iii) Any indications that the pipe material next to the weld has been damaged in any way (eg. Arc Burn, mechanical damages, weld beads, defects in the weld seam of the line pipe) shall be a reason to reject the weld.

Suitable records shall be maintained by the CONTRACTOR as desired by the COMPANY on the day-to-day work done on welding radiography, ultrasonic testing. The CONTRACTOR shall present the records to the COMPANY on day-to-day basis and whenever demanded, for approval.

12.6 Destructive Testing

The COMPANY has the authority to order the cutting of up to 0.1 % of the total

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number of welds completed for subjecting to destructive tests at no extra cost to COMPANY. The destructive testing of weld joints shall be made as per Annexure - 1. In addition, welds already cut out for defects for any reason may also be subjected to destructive testing. The sampling and the re-execution of welds shall be carried out by the CONTRACTOR at his own expense. If the results are unsatisfactory, 2 no's of joints at random shall be selected for destructive test if the first selected joint fail and welding operations shall be suspended and may not be restarted until the causes have been identified and the CONTRACTOR has adopted measures, which guarantee acceptable results. If it is necessary in the COMPANY's opinion the procedure shall be requalified. The weld joint represented by unsatisfactory welds shall stand rejected unless investigation proves otherwise.

13.0 REPAIRS OF WELDS

13.1 With the prior permission of COMPANY welds, which do not comply with the standards of acceptability, shall be repaired or the joint cut out and re-welded. Double repair not permitted. A separate welding procedure specification sheet shall be formulated and qualified by CONTRACTOR for repair welds simulating the proposed repair to be carried out. Separate procedures are required to be qualified for (a) through thickness repair (b) partial thickness repair (c) cover pass repair. Welders shall be qualified in advance for repairs. The root pass, for repairs opening the root, shall be replaced by the vertical uphill technique. The procedure shall be proven by satisfactory procedure test to API-1104 including the special requirements of the specification, and shall also be subjected to metallographic examination, hardness surveys and Charpy tests to determine the effects of repair welding on the associated structure.

Root sealing or single pass repair deposit shall not be allowed. Internal root defects shall be ground thoroughly and welded with a minimum of two passes. However, while grinding for repairs, care shall be taken to ensure that no grinding marks are made on the pipe surface anywhere.

The repair shall be subjected, as a minimum requirement to the same testing and inspection requirements as the original weld. After the repair of the circumferential weld, re-radiography of the full joint shall be carried out. Any repaired area that is wide, irregular or rough shall be rejected and a full cut out shall be done.

Repairs are limited to a maximum of 30% of the weld length. Not more than one repair are permitted on each girth weld if the weld after repair is found not acceptable, then complete weld including the HAZ shall be removed. All repairs shall be carried out the day after initial radiography or earlier. A full report of all repairs made shall be submitted every day to the COMPANY.

13.2 Weld Rejected by Accumulation of Defects

Where a weld is rejected by the accumulation of defect clause, as defined by API-1104 and this specification, repairs within these limitations are permitted. Defects in the filling and capping passes shall be repaired preferentially.

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ANNEXURE-I

1.0 DESTRUCTIVE TESTING OF WELDED JOINT - BUTT WELDS

1.1 Preparation

Having passed the visual and the non-destructive inspection, the test weld shall be subjected to mechanical test.

After satisfactory completion of all visual and non-destructive testing the procedure test weld shall be set-aside for a period not less than 24 hours. No further work on the test weld and no cutting of test specimens from the weld shall be performed until a period of at least 24 hours has expired.

Weld specimens shall be taken from the positions indicated in fig.1, 2, 3 & 4 of this specification from areas as free from defects as possible; for this reason, it is necessary to take the previous non-destructive tests into account. The minimum number of tests to be carried out is given in Table - 1 of this specification.

The test shall be carried out at laboratories approved by the COMPANY. The specimens shall be prepared in accordance with the figures given in the paragraphs that refer to the individual test.

1.2 Tensile Strength

Specimens shall be taken from the position indicated in fig.1, 2, 3 & 4 of this specification and Table-1 of this specification.

1.2.1 Method

The test shall be carried out in accordance with API 1104.

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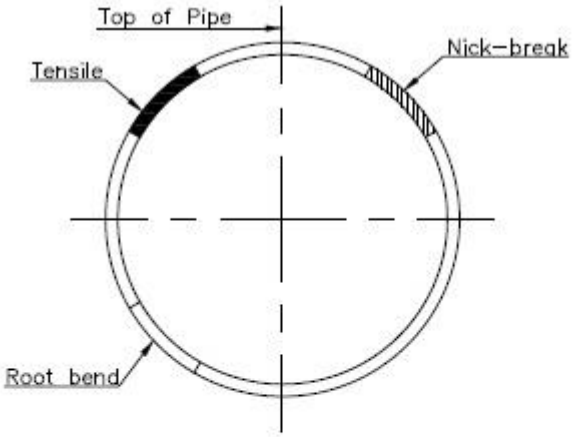
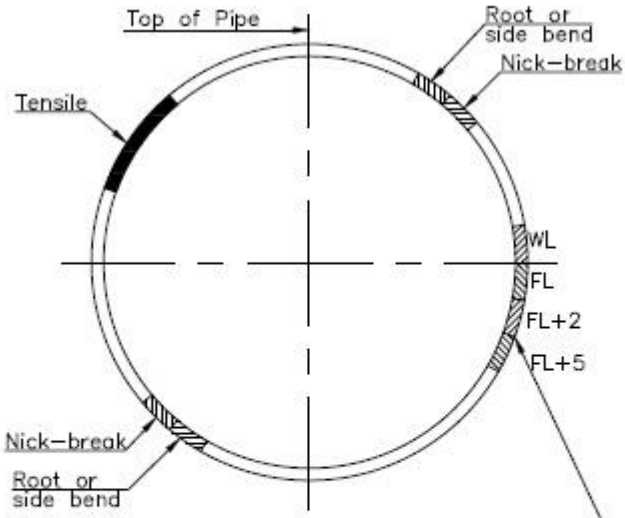


Under
2.375 in.(60.3mm)
FIG. -1



Greater than or equal to 2.375 in. (60.3mm)
but less than or equal to 4.500 in. (114.3mm);
also, less than or equal to 4.500 in. (114.3mm)
when wall thickness is greater than
0.500 in.(12.7mm)

FIG. -2

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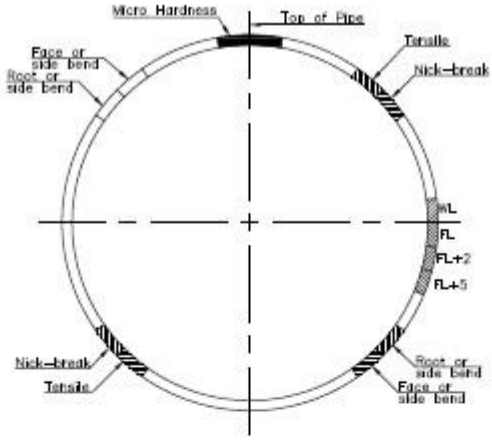
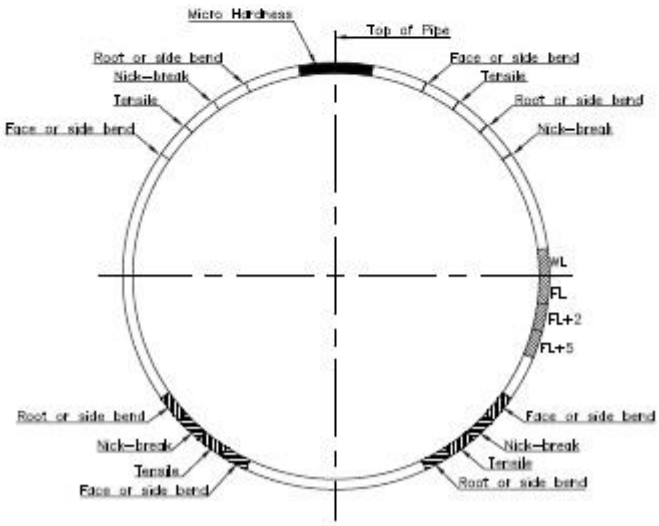


Greater than 4.500 in. (114.3mm); but less than or equal to 12.750 in. (323.9mm)
FIG. -3



Greater than 12.750 in. (323.9mm)
FIG. -4

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TABLE 1

OUTSIZE DIAMETER OF PIPE (mm)	NUMBER OF SPECIMENS							
	TENSILE STRENGTH	NICK BREAK	ROOT BEND	FACE BEND	SIDE BEND	MACRO & HARDNESS	IMPACT	TOTAL
	WALL THICKNESS ≤ (12.7 mm)							
<60.3	1	2	2	0	0	0	0	5
60.3 to 114.3	1	2	2	0	0	0	12	17
>114.3 to 323.9	2	2	2	2	0	2	12	22
>323.9	4	4	4	4	0	2	12	30
	WALL THICKNESS > (12.7 mm)							
≤ 114.3	1	2	0	0	2	0	12	17
>114.3 to 323.9	2	2	0	0	4	2	12	20
>323.9	4	4	0	0	8	2	12	30

1.3 Nick-Break Test

1.3.1 Preparation

Specification for nick-break test with notches thus worked can break in the base metal, instead of in the fusion zone; therefore an alternative test piece may be used after authorization by the COMPANY with a notch cut in the reinforcement of outside weld bead to a maximum depth of 1.5mm, measured from the surface of the weld bead.

1.4 Macroscopic Inspection

1.4.1 Preparation

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Specimens shall be taken from the positions indicated in Fig. 1 of this specification and shall be prepared in accordance with ASTM E2 and E3. The width of the macro section has to be at least three times the width of the weld. The section is to be prepared by grinding and polishing and etched to clearly reveal the weld metal and heat affected zone.

1.4.2 Method

Specimens shall be carefully examined under the microscope, with a magnification of at least 25 times (25:1). The COMPANY may ask for a macrograph with 5 times (5:1) magnification, for DOCUMENTATION purposes.

1.4.3 Requirements

Under macroscopic examination, the welded joints shall show good penetration and fusion, without any defect exceeding the limits stated in the evaluation criteria of the nick bream test

1.5 Hardness Test

1.5.1 Preparation

The prepared macro section is to be used for hardness testing using the vickers method with 10 kg load indentations are to be made along traverses each approximately 1 mm below the surface at both side of the weld.

In the weld metal a minimum of 6 indentations equally spaced along the traverses are to be made. The HAZ indentations are to be made along the traverses for approximately 0.5 mm each into unaffected material, and starting as close to the fusion line as possible.

One indentation at each side of the weld along each traverse has to be made on parent metal. Reference is made to Fig. 3 of this specification. The indentations are to be made in the adjacent region as well as on the opposite side of the macro section along the specified traverses.

1.5.2 Method

The test shall be carried out in accordance with recommendation ISO R81, Vickers hardness, using a laboratory type machine controlled as pre-recommendation ISO R 146 and using a diamond pyramid penetrator set at 2.37 rad (136") with a load of 10 kg.

1.5.3 Requirements

Hardness value shall not exceed the limit specified in welding specification chart. In case of a single reading strictly (+ IOHV) higher than the specified limit, further indentations shall be made to check if the high value was an isolated case.

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All the hardness values contained from the heat-affected zone shall not exceed 100 HV with respect to the average hardness of the values obtained for the base metal. If these additional tests give hardness within the specification limit the slightly higher value may be accepted.

1.6 Charpy V-Notch Impact Test

1.6.1 Specimens shall be taken from the position indicated in Fig. 2 ,3 & 4 of this specification. The test specimens will be prepared in accordance with API 1104. Charpy V-Notch specimens shall have dimensions as given in Fig. 6 of the specification. Three test specimens shall be taken from each sample and they shall be cut and worked so that their length is transversal and perpendicular to the weld bead with the notch position as shown in Fig. 6 of this specification. The notch shall be to the roller surface perpendicular to the roller surface. The test shall be conducted at -29 deg C and as per ASTM A370.

1.6.2 Requirements (Note 1)

The impact energy shall be:

Test specimen in (mm)	Average of three specimen (Note 2) joule (Min.)	Minimum single value (Note 1)
10.0	27.0	22.0
7.5	21.5	17.5
5.0	18.5	15.0
2.5	10.0	8.0

Note:

(1) These values are specified for resistance to brittle fracture only. Where additional requirements are specified in project data sheet (Ex. pipeline materials with arrest properties i.e. a higher upper shelf charpy V energy for resistance against propagating ductile fractures) the same shall be followed.

(2) Only one value is permitted to be lower than average value up to the value specified.

1.7 Bend Test Requirements

The Bend test Specimens shall be made and tested as per the requirements of API 1104 Latest edition (edition in force at the time of floating enquiry).The acceptance criteria shall be as per API 1104.

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ANNEXURE-2

1.0 ULTRASONIC INSPECTION

In addition the radiographic inspection, ultrasonic inspection is required as per conditions listed in paragraph 12.5 of this specification. This section concerns manual ultrasonic inspection. However ultrasonic inspection by automatic equipment may be used if approved by the COMPANY.

1.1 General:

The CONTRACTOR who carries out the ultrasonic inspections shall have sufficient no. of qualified personnel, equipment and instruments at his disposal to be able to effect the tests without hindering or delaying the pipeline assembly operations. The CONTRACTOR appointed to carry out ultrasonic inspections shall supply all the instruments necessary for their execution on site.

1.2 Specification for Ultrasonic Testing Procedure Qualification

Before work begins, the CONTRACTOR shall present a specification describing the proposed U.T. procedure qualification. This specification shall state, all the parameters described in API 1104 and the following information:

a) Type of U.T. Equipment used;

b) Type and dimensions of transducers

c) Frequency range

d) Details for calibration

e) Coupling medium

f) Inspection technique

g) Record details

h) Reference to the welding procedure where it is intended to adopt the specification

I) Temperature range of the joints to be inspected.

1.3 Qualification of Ultrasonic Inspection Procedure

The ultrasonic inspection procedure shall be approved by the COMPANY. Before inspection begins, the COMPANY may require the qualification test of the ultrasonic inspection procedure. This specification test consists in testing (under normal operating conditions) some CONTRACTOR welds made according to the same production procedure, where there are typical defects the test intends to detect.

This test shall be conducted in the presence of the COMPANY.

1.4 Test Procedure

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Circumferential welds shall be inspected from both sides using angle probes. The surface with which the probe comes into contact shall be free of metal spatter, dirt, iron oxide, and scales of any type; therefore it shall be necessary to clean a strip at least 50 mm wide on both sides of the weld with steel-wire brushes and anyhow the cleaned strip must be at least wide enough to allow one and a half skip examination.

If, during the test, echoes of doubtful origin appear, it shall be necessary to inspect a convenient area on the pipe surface, close to the weld, with a straight beam transducer in order to check whether any manufacturing defects are present which could have interfered with the ultrasonic beam.

By way of an example, the equipment shall include but not be limited to the following:

a) Ultrasonic equipment and coupling medium

b) Sample sections for calibration of instruments

c) Equipment for cleaning of surface to be examined

d) Rules calibrated in centimeters for exact location of the position of defects.

The characteristics of the above listed instruments and equipment shall guarantee:

a) That the required standards of the inspection procedure, as previously established an approved by the COMPANY, are satisfied.

b) Continuous operation

All the instruments and equipment shall be approved by the COMPANY before being used. The COMPANY has the authority to reject any item that is considered unsuitable. The decision of the COMPANY is final. The CONTRACTOR appointed to carry out ultrasonic inspections shall also ensure the operational efficiency and maintenance of the instruments and equipment, and shall immediately substitute any item rejected by the COMPANY.

All the instruments and equipment necessary for carrying out ultrasonic inspection on site shall satisfy the requirements laid down by the public boards of institutions that regulate 'safety at work'.

1.5 Ultrasonic Instruments

The ultrasonic instrument:

a) Shall be pulse echo type, able to generate, receive and display, on the screen a Cathode Ray Tube (CRT), pulse at frequencies between 1 and 6 MHz. The useful part of the CRT screen shall be at least 70mm wide and at least 50mm high shall have variable amplification, with steps of 1 or 2 dB over a range of a least 60 dB.

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b) the regulation control shall be accurate to within ±I dB and this accuracy shall be certified by the instrument manufacturer.

c) may be powered by a battery or an electric generator. In the first case, the autonomy of operation (endurance) of the instrument shall be sufficient to carry on working without frequent interruptions, and the instrument shall be equipped with an automatic switch which switches if off when the battery runs down; in the second case, there must be a voltage stabilising device with a tolerance of ±2 Volts.

1.6 Probes

The probes used shall have dimensions, frequencies, and a refraction angle suited to the type of steel, the diameter, and the thickness of the pipeline and to the joint design.

1.7 Reference Sample Pieces

The efficiency of the equipment used, the effective refraction angle of the probe, and the beam output point, shall be checked using a VI and V2 sample block, IIW type or the calibration block ASTM E-428.

For manual ultrasonic testing and automated ultrasonic testing the reference sample pieces shall be as described in API 1104, Nineteenth Edition, para 11.4.5.

1.8 Calibration

The calibration, qualification of the testing procedure shall be done as provided in API 1104.

1.9 Regulation of Amplification during Production Testing

Scanning sensitivity shall be as provided in API 1104 para 11.4.7.2 & 11.4.7.3. 1.10 Qualification of Ultrasonic Testing Operators for Automatic UT. Before the inspection begins or during the same inspection, the COMPANY may require a qualification test for the ultrasonic equipment operators.

The operators shall be fully qualified as per a recognized standard (ASME Sec V or equivalent) and they shall have as minimum level II as described in API II04. The operators shall be able to:

a) calibrate the equipment;

b) perform an operational test under production conditions;

c) interpret the screen picture;

d) evaluate the size and location of reflectors

e) interpret the type of defects detected

The COMPANY has the option of checking the ability of personnel employed for ultrasonic

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Testing by means of qualification tests.

1.11 Evaluation of Indications given by Ultrasonic Tests

Each time that echoes from the weld bead appear during production testing, the instrument amplification shall be altered to coincide with the reference amplifications and the probe shall be moved until maximum response is obtained, paying attention all the time to the probe-tube coupling.

If, under these conditions, the height of the defect echo is equal to or greater than that of the reference echo, the defect shall be evaluated according to clause 12.5 of this specification. If the defect has also been detected by the radiographic and/or visual examination, the dimensions shall be judged according to the type of examination which detects the greater defect. Returns that are less than 50% of the reference echo will not be considered. If returns are above 50% but lower than 100% of the reference echo, and if the operator has good reasons to suspect that the returns are caused by unfavorably oriented cracks, he shall inform the COMPANY. Moreover, when there is a defect to be repaired, such defect shall be removed for a length corresponding to the one where no more return echo is given.

1.12 Other Equipment

The use of rules calibrated in centimeters, attached if possible to the probe, for the precise location of the position of welding defects, is recommended. Defect location is effected by measuring the projection distance between the probe output and the reflecting surface.

The operators carrying out the tests shall have, besides the probing instrument, tools for cleaning the pipe surface (files, brushes, etc.) as well as the coupling liquid or paste appropriate for the temperature of the section to be examined.

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ANNEXURE-3

RADIOGRAPHY

1.0 SCOPE

This annexure covers the radiographic inspection of all types of welded joints of the main pipeline.

The welded joints shall include the following:

i) Full girth welds on the mainline construction including double jointing of pipe, if adopted.

ii) Welds for installation of block valves, insulating joints and other appurtenances and tie-ins.

iii) Welds at scraper launching and receiving barrels.

iv) Terminal Piping

2.0 APPLICABLE STANDARDS

This specification shall apply in conjunction with the following (all latest editions):

i) API 1104, Standard for welding Pipelines and Related Facilities

ii) ANSI B 31.8, Code for Gas Transmission and Distribution Piping Systems.

iii) ANSI B 31.4, Code for Transportation System for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols.

iv) ASTM E 94, Recommended practice for Radiographic Testing

v) ASTM E 142, Standard Method for Controlling Quality of Radiographic Testing

vi) The American Society for Nondestructive Testing. Recommended Practice no. SNT-TC-IA Supplement A.

3.0 PROCEDURE

3.1 The radiographic examination procedure to be adopted shall be submitted by the CONTRACTOR as per EXhibit-F.

3.2 The procedure of radiographic examination shall be qualified to the entire satisfaction of COMP ANY prior to use. It shall include but not be limited to the following requirements:

i) Lead foil intensifying screens, at the rear of the film shall be used for all exposures.

ii) Type 2 and 3 films as per ASTM E-94 shall be used.

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iii) A densitometer shall be used to determine film density. The transmitted film density shall be between 2.0 and 3.5 throughout the weld. The unexposed base density of the film shall not exceed 0.30.

iv) Radiographic identification system and documentation for radiographic interpretation reports and their recording system.

3.3 The CONTRACTOR shall qualify each procedure in the presence of the COMPANY prior to use.

3.4 The procedure of radiographic examination shall produce radiographs of sufficient density, clarity and contrast so that defects in the weld or in the pipe adjacent to the weld are clearly discernible.

3.5 One Check shot of the full joint on main line welds shall be taken per 100 circumferential welds or one per day of the production whichever is more for cross checking the correctness of the radiographs of weld joints executed by the contractors. For taking check shots on completed/accepted sections, contractor has to separately mobilize either internal crawler/external X-ray unit, as appropriate.

3.6 All the girth welds of mainline shall be subjected to 100% radiographic examination. The CONTRACTOR shall furnish all the radiographs to the COMPANY, immediately after processing them, together with the corresponding interpretation reports on approved format. The details of the radiographs along with the joint identification number shall be duly entered in a register and signed by the CONTRACTOR and submitted to the COMPANY for approval.

3.7 When the radiation source and the film are both on the outside of the weld and located diametrically opposite each other, the maximum acceptable length of film for each exposure shall not exceed the values given. The minimum film overlap, in such cases, shall be 40mm. The ellipse exposure technique may be used on nominal pipe sizes of 2 inch and smaller provided that the source of film distance used is a minimum of 12 inch.

3.8 Three copies of each acceptable radiographic procedure (as per Exhibit-F) and three copies of radiographic qualification records shall be supplied to COMPANY. One set of the qualifying radiographs on the job shall be kept by the CONTRACTOR's authorized representative to be used as a standard for the quality of production radiographic during the job. The other two sets shall be retained by COMPANY for its permanent record.

3.9 Three copies of the exposure charts relating to material thickness, kilo voltage, source of film distance and exposure time shall also be made available to COMPANY by the CONTRACTOR.

3.10 The CONTRACTOR shall, on a daily basis, record for each radiograph (1) radiograph's number, (2) approximate chainage of weld location, (3) whether or not the welds meet the specified acceptance standards and (4) the nature and approximate location of unacceptable defects observed. It must be possible to relate back to a particular butt weld and welder on piping drawing and pipeline alignment drawing.

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3.11 Each day's production of processed radiographs shall be properly packaged separately, identified by at least the (1) date, (2) radiographic unit, (3) job locations, (4) starting and ending progress survey stations and (5) shall include original and three copies of the daily radiographic record. The package shall be submitted to the COMPANY daily when possible, but in no event later than noon of the following day.

3.12 The CONTRACTOR shall provide all the necessary facilities at site, such as a dark room with controlled temperature, film viewer etc. to enable the COMPANY to examine the radiographs.

3.13 The CONTRACTOR, if found necessary, may modify the procedure of radiographic examination suiting to the local conditions prevailing. This shall, however, be subject to the approval of the Company.

3.14 COMPANY shall have free access to all the CONTRACTOR's work facilities in the field.

3.15 Any approval granted by the COMPANY shall not relieve the CONTRACTOR of his responsibilities and guarantees.

4.0 RADIATION SOURCE

4.1 Radiographic examination shall be carried out using X-radiations; radiographic examination by Gamma rays using slow speed films may be allowed, at the discretion of the COMPANY, in case of inaccessible joints. Radiography by Gamma ray for tie-in-joints shall be acceptable provided D4 AGF A film or equivalent is used and the required sensitivity obtained.

4.2 Whenever possible, pipeline welds will be inspected by placing the radiation source inside the pipe. on the pipeline axis. with a radiation of 6.28 red. (360).

5.0 LEVEL OF QUALITY

The quality level of Radiographic sensitivity required for radiographic inspection shall be at least equivalent to the values in Figure-7.

6.0 PENETRAMETERS

The Image Quality Indicator (abreviation:IQI) shall be used for the qualification of the welding procedure and during normal line production. Radiographic sensitivity shall be measured with the wire image quality indicator (Penetrameter). The Penetrameter shall be selected according to DIN-54109 or ISO-l 027. For radiographs made with the source on the outside, a Penetrameter shall be placed on each side of the film with the smaller wire of the Penetrameter turned towards the end of the film itself. When a complete weld is radiographed in a single exposure using a source inside the piping, four pentrameters approximately equally spaced around the circumference shall be used. During the procedure qualification, IQI shall be placed both on the source side and on the film side.

The sensitivity obtained with IQI on the source side shall not be less than the values shown in Fig. 7 of this specification. The sensitivity limit may be considered to have

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been reached when the outline of the IQI, its identification number and the wire of the required diameter show up clearly on the radiograph.

The COMPANY may authorize use of types of IQI other than those planned, provided that they conform with recognized standards and only if the CONTRACTOR is able to demonstrate that the minimum sensitivity level required is obtained. For this demonstration, a test shall be carried out comparing the IQI specified and the CONTRACTOR's to show up the identification number and other details of the proposed IQI, which must be visible in the test radiograph.

7.0 FILM IDENTIFICATION MARKERS

All films shall be clearly identified by lead numbers, letters, and/or markers. The image of the markers shall appear on the films, without interfering with the interpretation. These markers positions shall also be marked on the part to be radiographed and shall be maintained during radiography.

8.0 PROTECTION AND CARE OF FILM

8.1 All unexposed films shall be protected and stored properly as per the requirements of API1104 standard and ASTM E.94.

8.2 The exposed and unexposed film shall be protected from heat, light, dust and moisture. Sufficient shielding shall be supplied to prevent exposure of film to damaging radiation prior to and following the use of the film for radiographic exposure.

9.0 RE-RADIOGRAPHY

9.1 The weld joints shall be re-radiographed in case of unsatisfactory quality of the radiographs, at the expense of the CONTRACTOR.

9.2 All the repaired weld joints shall be re-radiographed at no extra cost to the COMPANY in the same manner as that followed for the original welds. In addition, the repaired weld areas shall be identified with the original identification number plus the letter R to indicate the repair.

9.3 When evaluating repair film, radiographers shall compare each section (exposure) of the weld with the original film to assure repair was correctly marked and original defect removed.

9.4 The COMPANY will review prior to any repair of welds, all the radiographs of welds that contain, according to the CONTRACTOR's interpretation, unacceptable defects. The final disposition of all unacceptable welds shall be decided by the COMPANY.

10.0 QUALIFICATION OF RADIOGRAPHERS

10.1 Pipeline radiographers shall be qualified in accordance with the requirement of API 1104 and to the full satisfaction of COMPANY.

10.2 Certification of all the radiographers, qualified as per 10.1 above, shall be furnished by the CONTRACTOR to the COMPANY before a radiographer will be

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permitted to perform production radiography. The certificate record shall include:

i) Background and Experience Record

ii) Training Course Record

iii) Technical Examination Record

iv) Doctor's report on radiographer's Jacque 0-1 acquity eye test

v) Date of qualification

10.3 The radiographers shall be required to qualify with each radiographic procedure they use, prior to performing the work assigned to him in accordance with the specification.

11.0 PRESERVATION OF RADIOGRAPHS

11.1 The radiographs shall be processed to allow storage of films without any discoloration for at least three years. All the radiographs shall be presented in suitable folders for preservation along with necessary documentation.

11.2 All radiographs shall become property of the COMPANY.

12.0 EQUIPMENT AND ACCESSORIES

12.1 CONTRACTOR shall make necessary arrangements at his own expense, for providing the radiographic equipment, radiographic films and all the accessories for carrying out the radiographic examination for satisfactory and timely completion of the job.

12.2 For carrying out the mainline radiographic examination the CONTRACTOR shall be equipped with suitable mobile/stationary type dark rooms. These shall have all the required facilities for film processing. Film viewer used shall be equipped with the film illuminator that has a light source of sufficient intensity and suitably controlled to allow viewing film densities up to 4.0 without damaging the film.

13.0 RADIATION PROTECTION

13.1 CONTRACTOR shall be responsible for the protection and personnel monitoring of every man with or near radiation sources.

13.2 The protection and monitoring shall comply with local regulations.

13.3 In view of visual hazards in the handling of Radioactive source of material, CONTRACTOR shall be solely responsible for complying with all rules and regulations set forth by Atomic Energy Commission or any other Government agencies of India in this regard and COMPANY shall not be responsible and shall be kept indemnified by the CONTRACTOR for default (s) of whatever nature by the CONTRACTOR. Safety equipment as considered adequate by the COMPANY

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for all necessary personnel shall be made available for use and maintained for immediate and proper use by the CONTRACTOR.

14.0 DISPLAY OF SAFETY INSTRUCTIONS

The safety provisions shall be brought to the notice of all concerned by display on a notice board at prominent place at the work spot. The person responsible for the "Safety" shall be named by the CONTRACTOR.

15.0 ENFORCEMENT OF SAFETY REGULATIONS

To ensure effective enforcement of the rules and regulations relating to safety precautions, the arrangement made by the CONTRACTOR shall be open to inspection by COMPANY or its representatives.

16.0 FIRST AID AND INDUSTRIAL INJURIES

16.1 CONTRACTOR shall maintain first aid facilities for its employees and those of sub-Contractors.

16.2 CONTRACTOR shall make outside arrangements for ambulance service and for treatment of industrial injuries. Names of those providing these services shall be furnished to COMPANY prior to start of work and their telephone no. Shall be posted prominently in CONTRACTOR'S field office.

16.3 All critical industrial injuries shall be reported promptly to the COMPANY and a copy of CONTRACTOR's report covering each personal injury requiring the attention of physician shall be furnished to the COMPANY.

17.0 NO EXEMPTION

Notwithstanding the above there is nothing in these to exempt the CONTRACTOR from the operation of any other act or rules in force.

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EXHIBIT- A

ELECTRODE QUALIFICATION TEST RECORD

A. Tested at (Site name) : Date:

Manufacturer's Narne

Brand Name: :

Batch Number & Size tested :

Classification & Code :

Intended for welding in position: :

In combination with (if any) :

Code of Reference (used for testing) :

Special Requirements (if any) :

B. All-weld Tensile Test :

Base Material used :

Pre-heat temperature :

Post weld heat treatment details: :

Visual examination :

Radiographic examination results :

Tensile test results :

Identification No.	U.T.S.	Yield Point	Elongation	Remarks
1.				
2.				

C. Impact Test Results

Test Temperature : Notch in

Type of Specimens (Charpy) :

Size of Specimens

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Specimen No.	Impact Value	Average
1		
2		
3		
4		
5		

D. Chemical Analysis Results

Electrode Size Result :

Batch No. :

%C	%S	%P	%Si	%Mn	%Cr	%Ni	%Mo	Other

.....	.....	.....
PREPARED BY (CONTRACTOR)	**REVIEWED BY (CONTRACTOR)**	**APPROVED (PMC/OWNER)**

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EXHIBIT- B

STRESS RELIEF HEAT TREATMENT PROCEDURE SPECIFICATION

Name of the Heat-treater :
Name of the Project : Specification Reference No.

1. General Detail:
   Name of the Equipment:
   Name of the Assembly/Part:
   Drawing No:
   Material:

2. Furnace Details
   Type of Heating : Gas/Oil/Elect.
   Res/ induction Type of Heating
   Capacity (Size)
   Maximum Temp. (C) :
   Method of temp. Measurement
   Atmosphere Control :

3. Heat Treatment Cycle Details
   Charging Temp. C
   Rate of heating, C/Hr.
   Soaking Temp. C
   Soaking Time, hrs.
   Rate of Cooling, C/Hr.
   Mode of Cooling

4. Other Details, if any :
   Notes:

   The following documents shall be furnished along with the specifications:
   i) Material test certificates
   ii) Assembly/Part Drawing.

.....	.....	.....
PREPARED BY CONTRACTOR)	**REVIEWED BY (CONTRACTOR)**	**APPROVED BY (PMC/OWNER)**

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EXHIBIT- C

QUALIFICATION WELD REPORT

Date_____ Test No._____ Test Type: _____ Procedure _____Welder Location _____

Welder (s) _____

_____

Material Grade 1 _____
Material Grade 2 _____
Outside Diameter _____ Wall Thickness _____
Joint Type _____ Bevel Angle _____
Backing Type (if applicable) _____ Roll or Fixed Position _____

RECORDED WELDING PARAMETERS

Pass	Process and Direction of Welding	Filler Metal Classification and Diameter	Shielding Gas type and flow rate or shielding flux	Preheat / Interpass Temperature	Voltage	Amperage	Travel Speed	Heat Input
Root Bead								
Second Bead								

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Time between passes: Root Bead to 2nd Bead: _____ , 2nd bead to 3rd bead: _____
Cooling Method (if applicable) _____
PWHT_____

MECHANICAL TEST RESULTS

TENSILE TESTS Report Number : _____

Specimen Number	Tensile 1	Tensile 2	Tensile 3	Tensile 4
Location				
Original specimen dimensions				
Original specimen area				
Maximum load				
Tensile strength				
Fracture Location				

NICK BREAK TEST Report Number :

Specimen Number	Nick 1	Nick 2	Nick 3	Nick 4	Nick 5	Nick 6	Nick 7	Nick 8
Location								
Result								

BEND TESTS Report Number:

Specimen Type and Number								
Location								
Result								

Remarks

Test made at _____ Date _____
Tested by _____ Supervised by _____

Sample Qualification Weld Report Form

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WELDING PROCEDURE SPECIFICATION

WPS Number _____

Process(es)/Method of Application _____
Material grade(s) _____
Outside diameter _____ Wall thickness _____
Joint type _____ Bevel angle _____
Backing type (if applicable) _____ Roll or fixed position _____
Direction of welding _____ Number of welders _____
Preheat temperature _____ Interpass Temperature _____
Method of Heating _____
Filler metal(s) and Flux _____
Flame characteristics _____ Cleaning and/or grinding tools _____
Type and removal of lineup clamp _____ Minimum number of passes _____
Maximum time between root pass and start of the second pass _____ Maximum time between second pass and start of third pass _____
Method of cooling _____ PWHT procedure _____

JOINT DESIGN

SEQUENCE OF BEADS

WELDING PARAMETERS

Pass	Process / Electrical Characteristics	Filler Metal Group or Classification	Electrode Size	Shielding Gas Type and Flow Rate or Shielding Flux	Voltage Range	Amperage Range	Travel Speed Range	Heat Input Range
Root Bead								
Second Bead								

Note: Number of weld beads are not intended to be limited by this table and the table should be adjusted to present all required passes.

Supporting qualification weld report No(s). _____
Approved by: _____

Sample Qualification Weld Report Form

.....	.....	.....
PREPARED BY CONTRACTOR)	**REVIEWED BY (CONTRACTOR)**	**APPROVED BY (PMC/OWNER)**

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EXHIBIT- D

Example of record form for welder qualification test

Welder test certificate	Test no
Project/Contract	Date
Contractor	Inspector
Welder's name	
Address	
Pipe material	
Pipe thickness	
Pipe outside diameter	
Welding process	Root
	Fill and Cap
Reason for failure	
Visual	
Non-destructive testing	
Butt joint	
Fillet weld	
'Number of attempts	
Comments	
Accepted date/Time	

Signed by Contractor

Signed by Inspector

*Delete as necessary

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EXHIBIT- E

Welder's Identification Card

Name	:	
Identification	:	Photograph
Date of Testing	:	
Valid till	:	
Approval of Welding	:	
Welding Position	:	
Material	:	
Diameter	:	
Diameter range approved	:	
Wall thickness	:	
Thickness range approved	:	
Type of welding consumables	:	

Approved by: Employers' Signature with seal

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EXHIBIT- F

Radiographic Procedure for Pipe Welding

1. Location
2. Date of Testing
3. Name of Supervised Contractor
4. Material
5. Dia & Thickness
6. Type of weld joint
7. Radiation Source (X-ray, iridium)
8. Type of equipment (External/Internal)
9. Intensifying screens and material
10. Filter type and placement mask, Diaphragm Lead screen etc. adjacent to radiation source or specimen,
11. Exposure Geometry (Source focal spot size, object to film distance, radiation angle with respect to weld and film).
12. Limit of film coverage
13. Film type and make
14. Exposure Conditions (rna, KV, time)
15. Processing (time temperature for development stop bath or rinse, fixation, washing, drying etc.)
16. Density
17. Sensitivity
18. Type of penetrameter
19. Essential wire to be seen on source side:
20. Essential wire accepted for film side viewing:

Approval of the COMPANY

Signature of CONTRACTOR with seal

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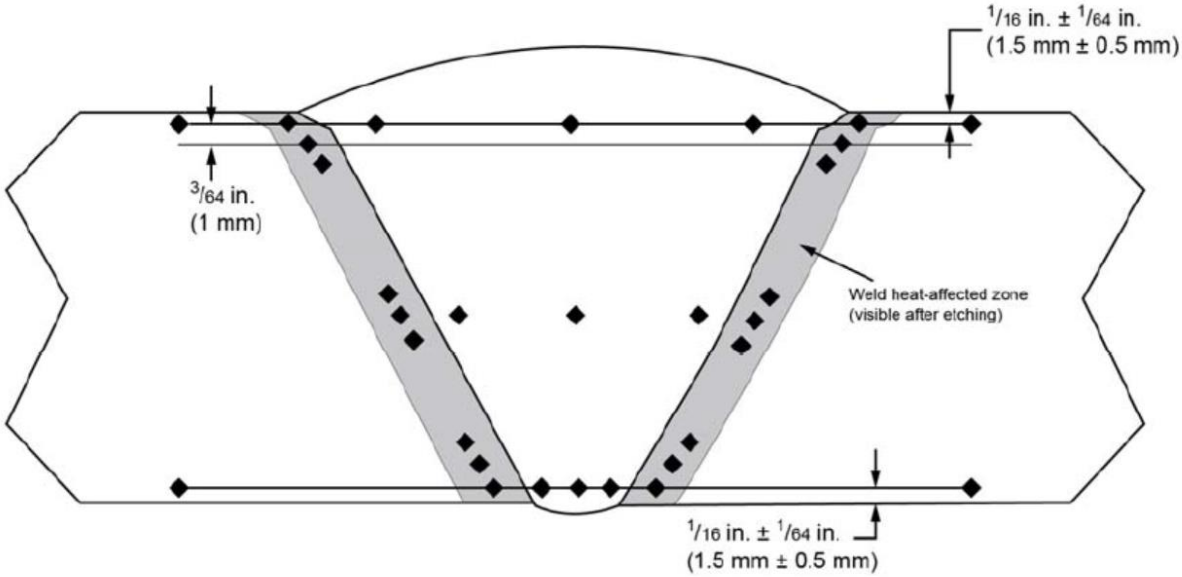

NOTE Heat-affected zone (HAZ) hardness impressions must be entirely within the HAZ and located as close as possible to the fusion boundary (between the weld metal and HAZ). The wall thickness of the specimen may prevent all the indents as shown from being made, particularly along the mid-point of the specimen.

HARDNESS TESTING – BUTT WELDS

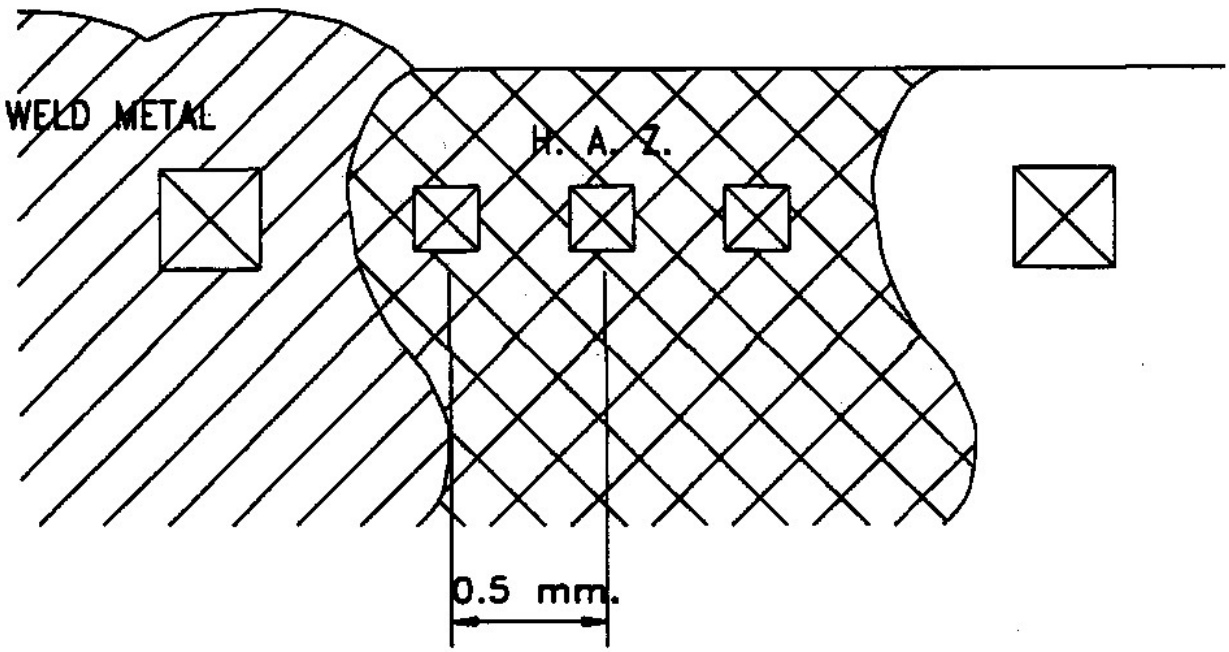

FIGURE 5

HARDNESS TESTING OF WELD JOINTS – SCHEMATIC

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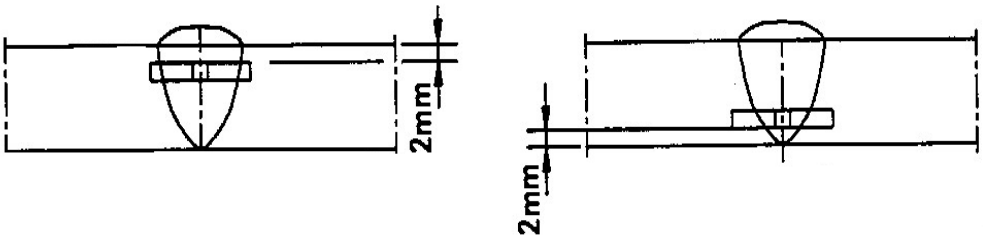
NOTCH POSITIONS

CENTER OF WELD



FUSION LINE (F.L)

2mm FROM F.L

5mm FROM F.L

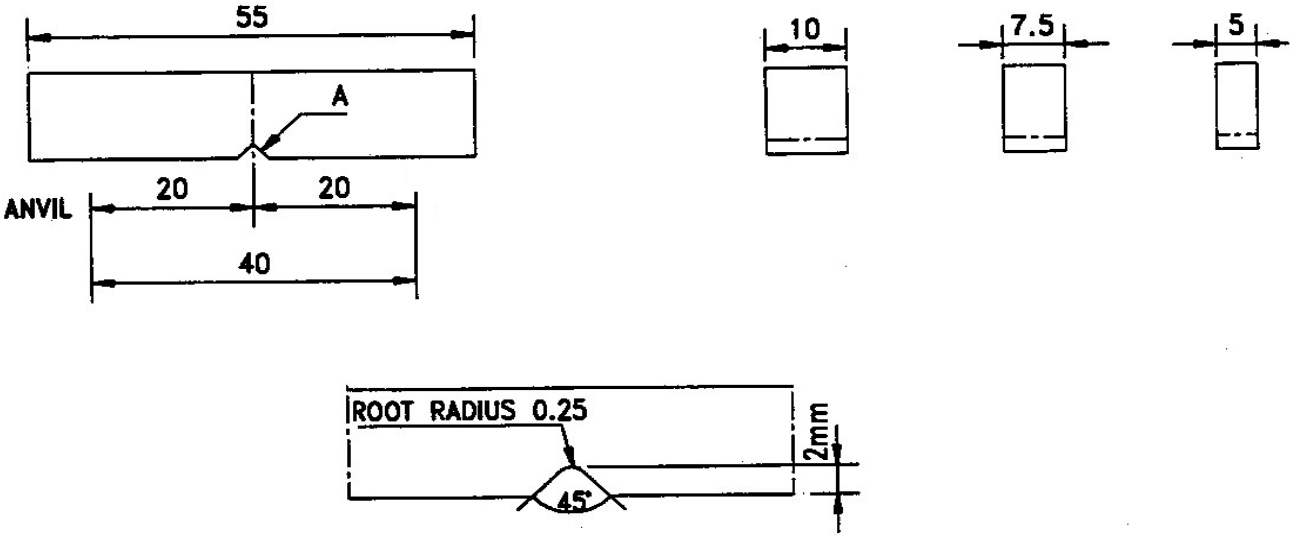


FIGURE 6

CHARPY V – NOTCH TEST SPECIMEN

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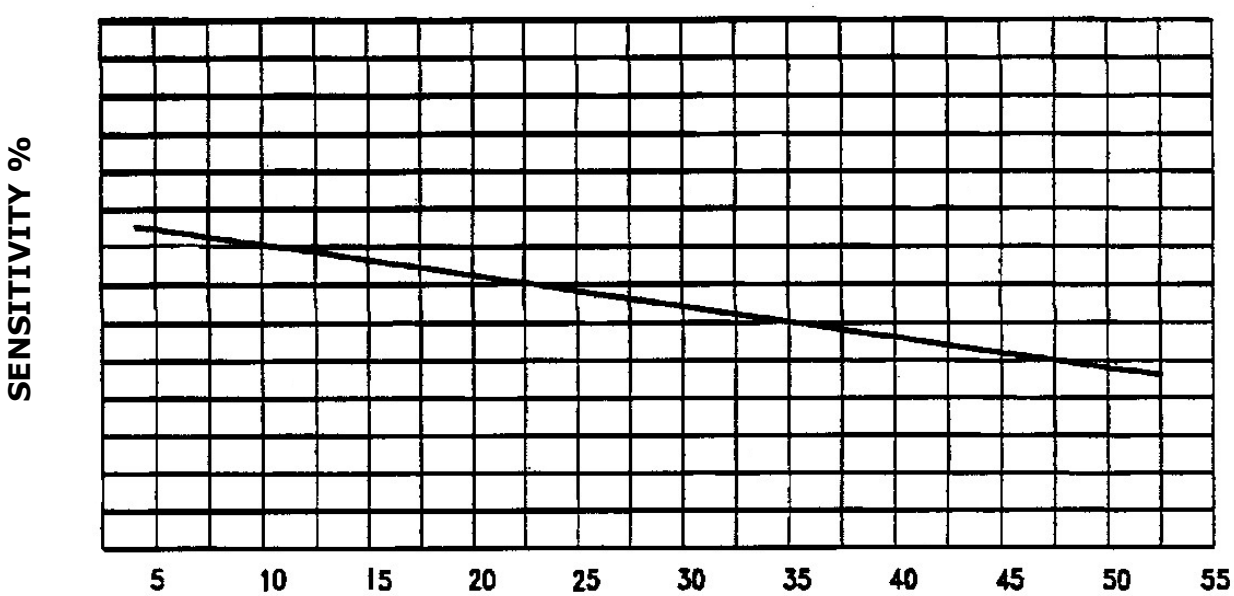

PIPE WALL MATERIAL THICKNESS mm

Figure-7

NOTE:-

FOR PRODUCTION RADIOGRAPHY, SENSITIVITY REDINGS BASED ON FILM ON SIDE PENTRAMETERS ARE TO BE JUDGED AS PER RESULT FROM THE PROCEDURE QUALIFICATION WITH PENTRAMETERS PLACED ON THE SOURE SIDE

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ENERGISING QUALITY	**WELDING SPECIFICATION CHART FOR PIPELINE WELDING**	**DOCUMENT NO :VCS-WS-PP-2039A** **REVISION :00**

12" PIPELINE (FOR WALL THK. 7.14, 8.38 & 9.53 mm)

MATERIAL SPECIFICATION	PIPES	API 5L Gr. X-70 (PSL-2)		
	FITTINGS	-		
	FLANGES	-		
	OTHERS	-		
BASE METAL 'P' NO	-			
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: SMAW	OTHER PASSES: SMAW	ROOT PASS: NA	OTHER PASSES: NA
	FILLET JOINTS/SOCKET JOINTS : NA			
WELDING MATERIAL	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: SFA-5.1 E6010	OTHER PASSES: SFA-5.5 E8010-P1	ROOT PASS: NA	OTHER PASSES: NA
	FILLET JOINTS/SOCKET JOINTS : - NA			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	API 1104, Latest edition			
GASES	PURGING:	NA	SHIELDING:	NA
GAS COMPOSITION	PURGING:	NA	SHIELDIN:	NA
PRE-HEATING	PRE-HEAT TEMP:	100°C (min)	INTER-PASS TEMP: 200°C (max)	
POST WELD HEAT TREATMENT	HOLDING TEMP:	NA	HOLDING TIME:	NA
	RATE OF HEATING:	NA	MIN. HOLDING TIME:	NA
	METHOD OF COOLING:	NA	RATE OF COOLING:	NA
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH IMPACT TEST VALUE:	MIN. :	22 J	AVERAGE : 27J
	AT TEMPERATURE:	-29°C		
	HARDNESS:	≤ 248HV_{10}		
	TENSILE:	AS PER APPLICABLE LINE PIPE		
CODE OF FABRICATION	API 1104 & APPLICABLE DESIGN CODE			

ENERGISING QUALITY	**WELDING SPECIFICATION CHART FOR PIPING WELDING**	**DOCUMENT NO : VCS-WS-PP-2039B** **REVISION :00**

PIPING CLASS: A1A, B1A, D1A (UPTO Y.S ≤ 490 MPa)

MATERIAL SPECIFICATION	PIPES	ASTM A106 Gr. B, API 5L Gr. B (PSL-2), API 5L Gr. X-70 (PSL-2), API 5L Gr. X-65 (PSL-2), API 5L Gr. X-60 (PSL-2), API 5L Gr. X-56 (PSL-2), API 5L Gr. X-52 (PSL-2), API 5L Gr. X-46 (PSL-2), API 5L Gr. X-42 (PSL-2), IS 1239 BLACK				
	FITTINGS	ASTM A105, ASTM A234 Gr. WPB, ASTM A234 Gr. WPB-W, MSS-SP-75 Gr. WPHY70/65/60/56/52				
	FLANGES	ASTM A105, ASTM A694 Gr. F-52/65/70, ASTM A516 Gr. 70				
	OTHERS	-				
BASE METAL "P" NO. 1						
WELDING PROCESS	GROOVE JOINTS					
	BUTT		OTHER THAN BUTT			
	ROOT PASS: GTAW/SMAW	OTHER PASSES: GTAW/SMAW	ROOT PASS: GTAW/SMAW	OTHER PASSES: GTAW/SMAW		
	FILLET JOINTS/SOCKET JOINTS : GTAW/SMAW					
WELDING MATERIAL	GROOVE JOINTS					
	BUTT		OTHER THAN BUTT			
	ROOT PASS: SFA-5.18 ER 70 S-2 /SFA-5.1 E6010	OTHER PASSES: SFA-5.18 ER 70 S-2 /SFA-5.5 E7018-1 / E8018-1	ROOT PASS: SFA-5.18 ER 70 S-2 /SFA-5.1 E6010	OTHER PASSES: SFA-5.18 ER 70 S-2 / SFA-5.5 E7018-1 / E8018-1		
	FILLET JOINTS/SOCKET JOINTS : SFA-5.5 E7018-1					
	BACKING RING: NA		CONSUMABLE INSERT: NA			
JOINT PREPARATION	ASME B 31.8 / ASME SEC.-IX					
GASES	PURGING		SHIELDING: ARGON			
GAS COMPOSITION	PURGING		SHIELDING: 99.995%			
PRE-HEATING	PRE-HEAT TEMP: 100°C (min)		INTER-PASS TEMP: 250°C (max)			
POST WELD HEAT TREATMENT	HOLDING TEMP:	NA	HOLDING TIME:	NA		
	RATE OF HEATING:	NA	MIN. HOLDING TIME:	NA		
	METHOD OF COOLING:	NA	RATE OF COOLING:	NA		
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH IMPACT TEST VALUE:		MIN. :	22 J	AVERAGE :	27J
	AT TEMPERATURE:		-29°C			
	HARDNESS:		≤ 248HV_{10}			
CODE OF FABRICATION	ASME SECTION IX & APPLICABLE DESIGN CODE					

NOTE:

1. Procedure shall be qualified based on thickness and P no. and G no., qualification ranges as per Section IX.
2. For piping up to diameter of 2", welding shall be carried at by GTAW.
3. Electrode E8018-1 will be used for pipe ≥ API 5L Gr. X 60 (PSL-2)

ENERGISING QUALITY	**WELDING SPECIFICATION CHART FOR LTCS PIPING WELDING**	**DOCUMENT NO : VCS-WS-PP-2039C** **REVISION :00**

PIPING CLASS: A4A, B4A, D4A (LOW TEMPERATURE AND UPTO SMYS≤ 490 MPa)

MATERIAL SPECIFICATION	PIPES	ASTM A333 Gr. 6		
	FITTINGS	ASTM A350 Gr. LF-2, ASTM A420 Gr. WPL6, ASTM A420 Gr. WPL6-W		
	FLANGES	ASTM A350 Gr. LF-2		
	OTHERS	-		
BASE METAL "P" NO. 1				
WELDING PROCESS	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: GTAW/SMAW	OTHER PASSES: GTAW/SMAW	ROOT PASS: GTAW/SMAW	OTHER PASSES: GTAW/SMAW
	FILLET JOINTS/SOCKET JOINTS : GTAW/SMAW			
WELDING MATERIAL	GROOVE JOINTS			
	BUTT		OTHER THAN BUTT	
	ROOT PASS: SFA-5.18 ER 70 SG / SFA-5.1 E6010	OTHER PASSES: SFA-5.18 ER 70 SG / SFA-5.5 E7018-1	ROOT PASS: SFA-5.18 ER 70 SG / SFA-5.1 E6010	OTHER PASSES: SFA-5.18 ER 70 SG / SFA-5.5 E7018-1
	FILLET JOINTS/SOCKET JOINTS : SFA-5.5 E7018-1			
	BACKING RING: NA		CONSUMABLE INSERT: NA	
JOINT PREPARATION	ASME B 31.8 / ASME SEC.-IX			
GASES	PURGING		SHIELDING: ARGON	
GAS COMPOSITION	PURGING		SHIELDING: 99.995%	
PRE-HEATING	PRE-HEAT TEMP: 100°C (min)		INTER-PASS TEMP: 250°C (max)	
POST WELD HEAT TREATMENT	HOLDING TEMP:	NA	HOLDING TIME:	NA
	RATE OF HEATING:	NA	MIN. HOLDING TIME:	NA
	METHOD OF COOLING:	NA	RATE OF COOLING:	NA
MECHANICAL PROPERTY REQUIREMENTS	CHARPY 'V' NOTCH IMPACT TEST VALUE:	MIN. : 22J	AVERAGE : 27J	
	AT TEMPERATURE:	-46.5°C		
	HARDNESS:	≤ 248HV_{10}		
CODE OF FABRICATION	ASME SECTION IX & APPLICABLE DESIGN CODE			

NOTE:

1. Procedure shall be qualified based on thickness and P no. and G no., qualification ranges as per Section IX.
2. For piping up to diameter of 2", welding shall be carried at by GTAW.

ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION
FOR
WARNING MAT

VPC – SS – PP -2020

03	**03.01.2022**	**SR**	**MC**	**HK**	**HK**
Rev. No	**Date**	**Prepared By**	**Checked By**	**Approved By**	**Authorized By**

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		SR	MC	HK	HK	

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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing of Materials
API	American Petroleum Institute

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1.0 SCOPE

This specification covers the minimum requirements for the various activities to be performed by for the procurement of Warning Mat.

Warning Mats shall be laid in the ground above the gas main line in order to indicate their presence.

This specification shall be read in conjunction with the condition of all specifications and documents included in the contract between company and contractor.

2.0 REFERENCE CODES, STANDARDS AND SPECIFICATIONS

The latest edition(edition in force at the time of floating enquiry) of following Codes, Standards and regulations are referenced in this specification and all provisions of these reference codes and standards shall be applicable.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4	:	Pipeline Transportation system for liquid Hydrocarbon & other liquids.
B 31.8	:	Gas Transmission and Distribution Piping Systems.

AMERICAN PETROLEUM INSTITUTE (API)

1102	:	Pipeline Crossing Railroads and Highways
1109	:	Marking Liquid Petroleum Pipeline Facilities
1104	:	Welding of Pipelines and Related Facilities

PNGRB REGULATIONS :

G.S.R 808(E) T4S	: Regulations for Natural Gas Pipelines
G.S.R. 612(E) T4S	: Regulations for CGD Network

US DOT PIPE LINE SAFETY STANDARD

Part 192, Title 49	:	Transportation of Natural and other Gases by Pipe Line
Part 195	:	Transportation of Liquid by Pipe Line

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3.0 FEATURES

Warning mat material shall be non-biodegradable type. It shall have non-toxic & anti-rodent properties.

3.1 MATERIAL

Warning Tape, Type 1 as per EN 12613 shall be used for the present project.

The material grade of Warning Mat shall be High density polyethylene (PE)/ PP material with warning sticker / stamp. The material shall be having the density between 0.913 to 0.923 g/cc at 27 deg. Celsius as per IS 2508.

The tape shall be uniform in colour, texture and finish and shall be free from holes and foreign materials.

Rodent repellent chemicals to be added to the plastic master batch for protection against rodents.

The material and colour, if used, for printing shall have no detrimental effects on the environment.

3.2 MECHANICAL PROPERTIES

Mechanical properties of the Warning Mat (Type I) shall be in accordance with the code EN 12613.

Minimum tensile withstand load in longitudinal direction shall not be less than 200 N. The test piece shall not exhibit a reduction of more than 20% of its width after removal of the specified load.

3.3 COLOUR

The Warning Mat shall be of bright golden yellow colour. This colour must not take any alteration in the course of time.

3.4 DIMENSIONS

Warning Mat shall have following dimensions:

Width	(D+500) ± 2 mm (Note-1)
Thickness	1.0 mm (Minimum)

'D' is diameter of mainline pipe.

Negative tolerance on the thickness is not allowed.

Note: Width of Mat shall be finalized during drawing approval stage.

3.5 MARKING

3.5.1 The warning mat shall be marked at intervals not exceeding 1 meter. Marking on the mat shall be approved by owner. The marking shall be legible and durable. The

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warning mat must be printed with "Caution: High Pressure Gas Pipeline Below" in English and Hindi/ Local Language, Chainage marking along with owner's logo and owner's 24 Hours Emergency Number ----------, ---------- at a frequency of every meter. In addition, name or trademark of the manufacturer, year of manufacture and reference of code of manufacture of warning mat shall be included in the marking.

3.5.2 Vendor shall submit proposed Artwork to be marked on the Warning Mat for approval from Owner / Owner's representative before start of production.

3.6 TESTS

All the tests and test procedures for Warning Mats shall be as per EN 12613 or as per required National/ International standards mentioned in EN 12613. In addition, all requirements pertaining to statutory requirements, if any, as specified from time to time shall be complied.

The required tests are briefed as below:

Colouring

Three separate tests shall be carried out in accordance with:

- As per normative annexure B of EN 12613, using 20% ammonium sulphide.
- As per EN ISO 175, using 10% nitric acid & 20% sodium carbonate solution.

The tests shall be repeated for each colour (if any).

There shall be no discolouration or change of the initial colour of the warning tape after the tests.

Tensile Withstand Strength

The test sample shall be selected as per mentioned in EN 12613. The test samples shall be preconditioned for not less than 12 h at 23±2 ºC. Static loads shall be carried out to the samples over a period of 10 s.

After the test, the test piece shall withstand without starting to separate at weak points (if any) for not less than 5 minutes. Also it should not exhibit a reduction of more than 20% of its width after removal of specified load.

The minimum tensile withstand load for the warning mat in the longitudinal direction shall be not less than 200 N.

Visual Warning Characteristics

The test shall be carried out in accordance with normative annexure A of EN 12613.

Permanence of Printing

The test shall be performed as per CL. 9.3 of IEC 60898:1995.

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The test is made by rubbing the marking by hand for 15 sec with a piece of cotton soaked with water and again for 15 sec with a piece of cotton soaked with aliphatic solvent hexane with a content of aromatics of max. 0.1% by volume, a kauributanol value of 29, an initial boiling point value of approx. 65°C, a dry point of approx. 69°C and a density of approx. 0.68 gm/cm^3.

After the test, the marking shall be easily legible.

Test of laying Characteristics

The test is for the assessment of transverse rigidity of the warning mats.

The test shall be performed as per EN 12613.

Warning Mat Virginity Test

Differential Scanning Calorimeter (DSC) Scan test along with the temperature of melting (Tm) shall be performed for the Warning Mat and its raw polymer i.e. virgin low density polyethylene (LDPE).

The Differential Scanning Calorimeter (DSC) Scan curve of the Warning Mat obtained from its DSC Scan test along with its Temperature of Melting (Tm) shall then be compared with the DSC Scan curve and the Temperature of Melting (Tm) of its raw polymer (i.e. virgin LDPE).

To ensure the virginity of the Warning mat, the DSC Scan curve and Tm of the Warning Mat (finished product manufactured from the raw polymer) shall match on overlapping with its corresponding raw polymer's DSC Scan curve and Tm.

4.0 PACKING

The warning mat shall be delivered in rolls of minimum 50 meters. Packing size to be mentioned to ensure uniformity in delivery conditions of the materials being procured. Packaging of the Warning Mat shall be such that there won't be any deterioration due to Ultraviolet (UV) effect during transportation and storage of the Warning Taps prior to use.

5.0 QUALITY ASSURANCE (QA)

Manufacturer shall prepare detailed Inspection Test Procedure (ITP) and submit for the approval from Owner / Owner's representative.

6.0 DEFECT LIABILITY

Defect liability period shall be as Specified in Tender.

7.0 RECOMMENDED MANUFACTURER FOR RAW MATERIAL

1. INEOS
2. BOREALIS
3. TOTAL PETROCHEMICALS
4. DOW
5. BASELL

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6. RELIANCE
7. GAIL
8. HALDIA

However, any other reputed national or international Manufacturer may also be considered for supply of Raw material with approval of Owner / Owner's representative.

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STANDARD SPECIFICATION
FOR
HEALTH, SAFETY & ENVIRONMENT

VPC – SS – PP - 2021

01	28.01.2020	MB	MC	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

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ABBREVIATIONS:

TPIA	THIRD PARTY INSPECTION AGENCY
QA	Quality Assurance
QC	Quality Control
LOI	Letter of Indent
QAP	Quality Assurance Procedure
ISS	International Standard Space
UPS	Uninterruptible Power Supply

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1.0 SCOPE

This specification establishes the Health, safety and Environment (HSE) aspects to be complied with by the contractor during construction at site.

2.0 REFERENCES

This document should be read in conjunction with following.

- General Condition of Contract (GCC)
- Special Condition of Contract (SCC)
- Job Specifications
- Relevant IS codes
- Reporting Formats

3.0 RESPONSIBILITY & ORGANISATION

Safety activities at site shall be under control of contractor's RCM. He shall be responsible for implementation of HSE provisions. The nominated or designated safety engineer/ officer shall assist and perform day to day HSE work as per his advice.

4.0 GENERAL REQUIREMENT

4.1 The contractor should follow HSE policy of owner as applicable to construction site.

4.2 The contractor shall deploy a full time HSE engineer / officer to coordinate the site.

The HSE officer shall be duly qualified in Industrial Health & Safety management with an experience of 4 -5 years.

4.3 The contractor shall ensure that HSE requirements are clearly understood & faithfully implemented at all level, at each site.

4.4 The contractor shall organize safety awareness programs regularly.

4.5 The contractor shall ensure his participation in the every HSE meeting called by owner/owner representative.

4.6 The contractor's shall conduct daily tool box talk.

4.7 The contractor shall submit Monthly HSE reports (Form attached in ANNEXURES).

4.8 The contractor shall provide all help and support to the injured person got injury at site during construction work and arrange compensation as per insurance policy / Act.

4.9 The contractor shall adhere consistently to all provisions of HSE. In case of non-compliance or continuous failure the owner/ owner representative may impose stoppage of work without any cost time implication to owner. A penalty amount of Rs 1000/- shall be imposed on the contractor for the serious HSE violation.

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4.10 Three times of this penalty may count as a serious violation of contractor in line with HSE. This may affect to new work assignment/award of contractor.

5.0 ACCIDENT, INCIDENT AND NEAR-MISS REPORTING

Accident

Unintended occurrence arising out of and in the course of employment of a person, which results in to injury with or without damage to plant/equipment/materials.

Incident

means an unplanned and uncontrolled event which results in damage to plant or equipment or loss of material without causing any injury to persons, like fire, spill, leak, property damage etc.

Near-miss

An unexpected, unwanted event not causing loss, injury or illness but which under slightly altered conditions can lead to an accident.
can be defined as "Any event which under slightly un favorable circumstances, may have resulted in any of the following:

- Injury, fatal or otherwise or ill health to people
- Loss of property, damage to plant or materials
- Damage to the environment
- A business interruption"

Accident, Incident and Near miss reporting form listed in ANNEXURES

6.0 HSE REQUIREMENTS AT SITE

6.1 Personnel Protective Equipment's

The contractors shall provide sufficient numbers of following personal protective equipment's (PPEs) to workmen and supervisors/engineers to use them properly at work site.
Following five numbers of Personnel protective equipment's are identified as MANDATORY for all.

- Safety Helmet
- Coverall
- Safety shoes/footwear
- Safety Glasses
- Hand Gloves (as per job requirement)

  Other PPEs are depending upon nature of job like

  Arc Welding – Welding face shield

  Grinding – Grinding face shield

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Height work – Full Body harness (above 2 meters)

Ask site supervisor for proper use and selection of protective clothing / equipment for specialized jobs

6.2 Welding

- Ensure that welding machine is in order and approved by site engineer.
- Ensure that welding cables are in order.
- Ensure that welding machine is properly earthed.
- Remove all combustible material from welding area to avoid fire
- Place a fire extinguisher nearby welding premises.
- Ensure welding holder, cable and its lugs in good condition and use only industrial power socket and plugs (3 Pin) to avoid electricity risk.
- Make sure that welding machine is provided with ON/OFF switch and is earthed/grounding.
- Do not over load electrical appliances and cable, Shocked pin etc,
- Ground the work piece separately from the welding return connection only.

6.3 Gas Cutting

- Check the cylinder and its valve or leakage and move out any leaking cylinder immediately.
- Ensure that flash back arresters are installed with torch and NRV (Non-return valve) on the gas cylinders side.
- Ensure cylinders in vertical position (Cylinder trolley) and far away from fall of sparks and hot metal.
- Check the regulator and torches that they are inspected prior to every use.
- Check for leaks around regulators, hoses/fittings & nozzle with soap solution.
- Check the entire hose length if it is cracked or worn out cut that length of hose or replace the hose.
- Check that flash back arrester used for the purpose is of approved make/specification only.
- Place a fire extinguisher nearby welding premises.

6.4 Grinding Operation

- Grinding wheels should be stored in dry place.
- After expiry date, grinding wheel must be condemned, broken in to pieces.
- Power supply cable of adequate current carrying capacity shall be used and it should be in good workable condition without abrasions, cuts or puncture in outer insulation.
- Socket pin provided at supply end and on/off switch in working condition.
- Proper earthing of the body in case of metallic body.
- Wheel guard properly fitted in position.

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- Machine body without any damage like crack etc.
- Moving part (wheel) must be properly fixed to the machine with the help of spanner.
- Grinding wheel must be of suitable size as per the speed of grinding machine.
- Grinding wheel without manufacturer's sticker showing size, speed and expiry date must be condemned.
- Don't use portable grinding machine as bench grinder.
- Don't fit over size wheel than recommended size by machine/wheel manufacturer.
- Don't grind small, unstable object without fixing it in the vice.
- Don't over press the grinding wheel against the job for fast removal of metal.
- Put OFF the main switch, while machine is not in use (tea break etc.)
- Don't chip off grinding/cutting wheel for achieving fast cutting rate.

PPEs:

- Use of helmet, face shield or safety goggles (where face shield is not possible.) and hand gloves.

6.5 Use of Power Tools and Cables

- All electrical equipment and tools used by the contractors and their employees shall be properly checked by contractor's supervisor before use.
- All power tools must have proper guard at all time.
- Leads /cables must be placed so that they do not create a tripping hazard.

6.6 Material Handling and storage

The Contractor will only use crane/Hydra and lifting equipment that has been tested and certified as fit for purpose by 3rd Party. All crane operators and riggers will be adequately trained and certified. The Contractor will keep records of tests and certification of all lifting equipment crane employed on the Works.
Maintenance records shall be routinely inspected by the Contractor and made available for Safety audits.

LIFTING GEAR: Lifting machine, chains, ropes and lifting tackles used at site shall conform to the following:

- All parts shall be good construction, sound material and adequate strength and free from defects.
- Shall be properly maintained, thoroughly examined, load tested by competent person.
- No lifting machine and no chain, rope or lifting tackle shall except for purpose of test be loaded beyond safe working load must be plainly marked on the gear concerned.
- All material must be properly stacked and secured to prevent sliding, falling or collapse.
- Stairs and passage ways must be kept clear at all time.

6.7 Trenches and Excavation

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Before commencing any excavation work the Site in charge will ensure that the proposed works have been adequately assessed and planned to ensure that they are executed safely and without risks to Health and safety. The factors to be assessed and planned will include: -

- The nature and stability of the material being excavated and the need for any support of walls.
- The effect of excavation on nearby area.
- The foreseeable presence of hazardous contaminants.
- The proximity of mobile plant.
- The provision of edge protection (fall prevention of people and materials)
- Access and egress

6.8 Pipe Transportation and lowering

- All drivers shall hold a valid driving license for the class of vehicle.
- Securing of the load shall be according to established and approved methods.
- All overhangs shall be made clearly visible and restricted to acceptable limits.
- Load shall be checked before moving off and after traveling a suitable distance.
- All vehicles used by Contractors shall be in worthy condition and in conformance to the Land Transport requirement.
- Use of certified side booms after 3rd Party inspection.
- Effective communication should be done among all involved personals.
- Signaling shall be done by authorized foreman only.
- Ensure appropriate measures are taken for overhead hazards.
- Persons are not allowed towards trench side / under the boom at the time of lowering.
- Co-ordination of lowering in by a single man only.
- Inspection of equipment before use.
- All personnel should stay clear of moving equipment.
- Use of certified lifting tools and tackles.

6.9 Pressure / Leak Testing

Hydraulic and Pneumatic Test

Access to the test area shall be limited to essential personnel only. before the test commences compliance is required with the following points:

- Persons supervising pressure or leak tests must have sufficient knowledge and experience of testing to fully understand the hazards of the activity and the precaution, which must be taken.
- Effective communication, including formal procedures, must be established between sites whenever the test envelope extends beyond one site, for example, pipelines.
- The area shall be cordoned off (using tape, shields or barriers, etc) at an adequate

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distance from the equipment to be tested, as specified on the Permit to Work

- Warning signs shall be posted at access ways, at other strategic positions, and on the equipment to be tested (including the doors of test workshops or other designated areas
- Pressuring equipment shall be provided with suitably calibrated pressure control / regulator devices.
- Pressuring equipment shall not be left unattended at any time during the test.
- Pressuring equipment shall be isolated from the equipment under test and where practicable disconnected, when the test pressure has been reached.
- Care must be taken to ensure that materials of construction have the required ductility at the test temperature to prevent brittle fracture.
- A safety valve should be fitted to the equipment/system being tested, set to relieve at a pressure that will prevent over pressurization
- Sufficient venting / draining points shall be provided in order to prevent trapping of pressurizing medium behind non-return valves, check valves, between isolation valves, or within dead legs of the pressure envelope
- The equipment/plant to be pressure tested must be subjected to thorough examination prior to testing. It may be necessary to 100% inspect all welds using visual, radiographic or other NDT techniques
- The gas supply must be isolated when test pressure has been achieved
- The pressure envelope must contain sufficient vents, to a safe location.
- De-pressurization after pneumatic testing must be gradual

6.10 Scaffolding and Ladder

- All working platform must be constructed with the specific requirement of job.
- All portable ladders must be in good condition as per the site norms.
- If the working platform is not permanent then safety belt must be used.
- There shall be firm foundation for all scaffoldings. All scaffolding shall be made of sound material.
- Scaffolding material shall be inspected and used, only if found in good condition.
- Provide metal base plate is used under all upright or standard scaffoldings. Correct type of couplers shall be used for all connections.
- Plumb and level scaffoldings as erection proceeds, so that braces will fit without forcing. Fasten all braces securely.
- Working platforms shall be provided with guards. This should consist of top rail, mid rail, and toe board. The toe board shall be of minimum height 100 mm, while the mid rail and top rail shall be at heights of 600 mm and 1200 mm respectively.
- Do not use ladders or makeshift devices on top of scaffoldings to increase the height.

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- Shall be placed at least 75 deg. to the floor.
- Ladder shall extend 3” to 4” above the point of Landing and topmost 3 rungs shall not be used.
- Ladder is checked visually for defects before every use.
- Ladders shall not be used in a horizontal position as runways or scaffoldings.
- Ladders shall not be placed in front of a door that opens toward the ladder unless the door is locked, blocked or guarded.
- Fall arrestor to be used where ever applicable.

6.11 Work Permit Procedure

- For working at more than 10’ height the permission must be obtained from site in-charge.
- For doing any Hot work in the fire risk areas the permission must be obtained from site in charge or safety officer.
- For any Excavation work it must be ensured that there are no under group utilities like cables, Water pipeline etc.
- For any work inside confined space, entry permit must be obtained from site engineer.

6.12 Barricades and Warning Signs

- Area where work is being carried out above man height or below 1’ ground depth must be barricaded.
- Follow the instruction of all types of warning signs like “NO SMOKING” “NO ENTRY” “DANGER” “Work at height”

6.13 Emergency Plan and Procedures

- All Contractor’s employees should be aware of site Emergency control plan
- Periodic drill to train employees for their awareness & information should be followed.

6.14 Road Safety Norms

- For roadside working site to be barricaded as per approved barricading norms Penalty clause for road safety & barricading shall be applicable as per relevant clause of commercial part of tender.
- Only eligible driver can drive required vehicle inside site
- Speed limit norms of site must be followed
- No riding or travelling on the back of open-end vehicle, fork lift or trailers should be done.

6.15 Labour Welfare & Legal Requirement

- All mandatory provisions with regard to safety as prescribed under contract Labour (Abolition & Regulation) Act 1970 and Rules made there under are applicable.
- Workmen compensation insurance and registration under ESI should be maintained.
- Time to time, all rules and regulations suggested by safety committee of site must be

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followed and implemented

ANNEXURE – A

RELEVANT IS-CODES FOR PERSONNEL PROTECTION

IS : 2925 – 1984	:	Industrial Safety Helmets.
IS : 4770 – 1968	:	Rubber gloves for electrical purposes
IS : 6994 – 1973 (Part – I)	:	Industrial Safety Gloves (Leather & Cotton)
IS : 1989 – 1986 (Part – I & III)	:	Leather safety boots and shoes
IS : 3738 – 1975	:	Rubber knee boots
IS : 5557 – 1969	:	Industrial and Safety rubber knee boots
IS : 6519 – 1971	:	Code of practice for selection, care and repair of Safety footwear
IS : 11226 – 1985	:	Leather Safety footwear having direct moulding sole
IS : 5983 – 1978	:	Eye protectors
IS : 9167 – 1979	:	Ear protectors.
IS : 3521 – 1983	:	Industrial Safety belts and harness

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ANNEXURE – B

FORMAT - 1.0

1.0: HEALTHY, SAFETY & ENVIRONMENT (HSE) PLAN

Project: ----------

Contractor: ----------

Date: ----------

Owner: …….

(To be prepared & submitted by each Construction Agency)

Activity Description	Procedure/ W.I./ Guidelines	Code of Conformance	Performing Function			Audit Function
			Performance	Checker	Approver	Customer Review/ Audit Requirements

PREPARED BY

REVIEWED

APPROVED BY

2.0 MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (1/6)

Project: _____ Contractor : _____

Date: _____ Owner : _____

Inspection By: _____

Note: write 'NC' (Not Concern) wherever any of the items are not applicable

Item	Yes	No	Remarks	Action
HOUSEKEEPING				
Waste containers provided and used				
Sanitary facilities adequate and Clean				
Passageways and Walkways Clear				
General neatness of working areas				
Proper Material Storage				
Wooden Boards properly stacked and nails removed				
Cords, leads out of walk and traffic ways				
Scraps removed from the work site				
Other				
PERSONNEL PROTECTIVE EQUIPMENT				
Goggles: Shields				
Face protection				
Hearing protection				
Safety Shoes provided				
Hand protection				
Respiratory Masks etc.				
Safety Belts				
Safety Helmets				
Other				
EXCAVATIONS / OPENINGS				
Excavation permit				
Excavated earth kept away from edge				
Dewatering pump kept away from edge				
Safe access into excavated area				
Opening properly covered or barricaded				
Excavations shored				
Excavations barricaded				
Overnight lighting provided				
Other				

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MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (2/6)

Item	Yes	No	Remark	Action
Welding Cutting				
Valid not work permit				
Flashback arrester provided for cylinders				
Power cable not crossing the welding cable				
Adequate earthing provided				
No combustible materials kept near welding & cutting works				
Gas cylinder chained upright & kept in trolleys				
Cables and hoses not obstructing				
Screens or shields used				
Flammable materials protected				
Fire extinguisher (s) accessible				
Other				
SCAFFOLDING				
Fully decked platform				
Guard and intermediate rails in place				
Toe boards in place & tied properly				
Adequate shoring				
Adequate access				
Other				
LADDERS				
Extension side rails I'm above				
Top of landing				
Properly secured at top & bottom				
Angle ± 70° from horizontal				
Other				

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MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (3/6)

Item	Yes	No	Remark	Action
HOISTS, CRANES AND DERRICKS				
Condition of cables and sheaves OK				
Condition of slings, chains, hooks and eyes OK				
Inspection and maintenance logs maintained				
Outriggers used				
Singh/ barricades provided				
Signals observed and understood				
Qualified operators				
Other				
MACHINERY, TOOLS AND EQUIPMENT				
Proper instruction				
Safety devices				
Proper cords				
Inspections and maintenance				
Other				
VEHICLE AND TRAFFIC				
Rules and regulations observed				
Inspection and maintenance				
Licensed drivers				
Others				

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MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (4/6)

Item	Yes	No	Remark	Action
TEMPORARY FACILITIES				
Emergency instruction posted				
Fire extinguishers provided				
Fire-aid equipment				
Secured against storm damage				
General nemeses				
In accordance with electrical requirements				
Other				
Fire Prevention				
Personnel instructed				
Fire extinguishers checked				
No smoking in prohibited areas				
Hydrants clear				
Other				
ELECTRICAL				
Proper wiring &earthing				
ELCB’s provided				
Ground fault circuit interrupters				
Protection against damage				
Prevention of tripping hazards				
Proper electrical cable joints				
Light poles secured				
Clear way to power distribution board				
Proper rating of fuses				

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MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (5/6)

Item	Yes	No	Remark	Action
HANDLING AND STORAGE OF MATERIALS				
Properly stored or stacked				
Passageways clear				
Other				
FLAMMABLE GASES AND LIQUIDS				
Containers clearly identified				
Proper storage				
Fire extinguishers nearby				
Other				
WORKING AT HEIGHT				
Erection plan				
Safety nets				
Safety belts tied properly				
Illumination				
No loose material at height				
No body under working area				
All openings covered				
Other				
ENVIRONMENT				
Chemical and other Effluents properly disposed				
Cleaning liquid of pipes disposed of properly				
Seawater used for hydrotesting disposed off as per agreed proceeding				
Lubricant Waste/ Engine oils properly disposed				
Waster from Canteen office, sanitation etc. disposed properly				
Disposal of surplus earth stripping materials, Oily rags and combustible materials done properly				
Green belt protection.				

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MONTHLY CHECKLIST CUM COMPLIANCE REPORT REGARDING HSE (6/6)

Item	Yes	No	Remark	Action
HEALTH CHECK				
Hygienic conditions at labour camps OL				
Availability of First Aid facilities				
Proper sanitation at site, office and labour camps				
Arrangements of medical facility				
Measures for dealing with illness				
Availability of potable drinking waters for workmen & staff				
Provision of cretches for children				
ERECTION				
Slings/ D'shakle checked				
Signal Man				
Tag line for guiding the load				
Protecting the slings from sharp edges				
No loose materials at height				
Ladder & platform welding inspected				
No one under the suspended load				
Stay rope				
SWL				

Signature of Resident
Engineer with Seal

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Monthly Health, Safety & Environmental (HSE) Report
(To be submitted by each Contractor)

Actual work start date: _____

For the month of: _____

Project: _____

Report No.: _____

Name of the Contractor: _____

Status as on: _____

Name of Work: _____

Name of Safety officer: _____

Item	This Month	Cumulative
Total strength (Staff – Workmen)		
Number of HSE meeting organised at site		
Number of HSE awareness programmes conducted at site		
Whether workmen compensation policy taken	Y/N	
Whether workmen compensation policy valid	Y/N	
Whether workmen registered under ESI Act	Y/N	
Number of Fatal Accident		
Number of Loss Time Accident (Other than Fatal)		
Other accident (non loss time)		
Total No. of accident		
Total man-hours worked		
Man-hour loss due to fire and accident		
Compensation cases raised with insurance		
Compensation cases resolved and paid to workmen		

Remark

Date: _____/_____/_____

Safety Officer/RCM

(Signature and name)

To: OWNER…… 1 COPY

RCM/SITE-IN-CHARGE 1 COPY

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SUPPLEMENTARY ACCIDENT, INCIDENT&NEAR MISS REPORT

Project: _____ Supplementary to Report No.: _____

(Copy enclosed)

Site: _____ Date: _____

Contractor: _____

NAME OF THE INJURED……...
FATHER'S NAME…….
SUB-CONTRACTOR M/S…….
DATE & TIME OF ACCIDENT……
LOCATION……

BRIEF DESCRIPTION & CAUSE OF A ACCIDENT

NATURE OF INJURY / DAMAGE

COMMENTS FROM MEDICAL PRACTITIONER WHO ATTENDED THE VICITIM/INJURED

SUGGESTED IMPROVEMENT IN THE WORKING CONDITION IF ANY

LOSS OF MANHOURS AND IMPACT ON SITE WORKS

ANY OTHER COMMENT BY SAFETY OFFICER

Date: _____/_____/_____/ SIGNATURE OF CONTRACTOR WITH SEAL

To : OWNER 1 COPY

: RCM/SITE-IN-CHARGE 1 COPY

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ACCIDENT REPORT

(To be submitted by Contractor after every accident within 2 hours of accident)

Report No._____
Date: _____

Name of Site: _____
COTRACTOR_____

NAME OF THE INJURED …….
FATHER'S NAME…….
SUB-CONTRACTOR M/S……..
DATE & TIME OF ACCIDENT……
LOCATION……

BRIEF DESCRIPTION OF ACCIDENT

CAUSE OF ACCIDENT

NATURE OF INJURY / DAMAGE

MEDICAL AID PROVIDED / ACTIONS TAKEN

INTIMATION TO LOCAL AUTHORITIES

Date: _____/_____/_____/

SIGNATURE OF CONTRACTOR WITH SEAL

To	:	OWNER	1 COPY
	:	RCM/SITE-IN-CHARGE	1 COPY

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ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION
FOR
PRE-COMMISSIONING
& COMMISSIONING OF PIPELINE SYSTEM

VPC – SS – PP - 2022

02	21.12.2020	MB	MC	AD	SK
Rev. No	**Date**	**Prepared By**	**Checked By**	**Approved By**	**Authorized By**

UNCONTROLLED COPY	:	**If printed**
CONTROLLED COPY	:	**If in soft and signed**

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REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	04.06.2019					Issued as Standard
		JV	MD	AD	SK	
01	28.01.2020					Document numbering updated from VPC-SS-PL-0039 to VPC-SS-PP-2022
		MB	MC	AD	SK	
02	21.12.2020					Re-Issued as Standard
		MB	MC	AD	SK	

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ABBREVIATIONS:

NACE	National Association of Corrosion Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society of Testing of Materials
BHN	Brinell hardness number
MSS-SP	Manufacturers Standardization Society - Standard Practice
LTCS	Low temperature Carbon Steel AS Alloy Steel

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1.0 SCOPE

The specification covers the minimum technical requirements for testing and commissioning of entire pipeline facilities including Commissioning activities such as pre-commissioning checks, dewatering, swabbing, flushing/blowing, leak testing etc.

2.0 GENERAL

The scope of work for testing & commissioning including Pre – Commissioning actives shall include but not limited to the manpower, machinery & equipments, detailed Procedures, Materials & Consumable, Communications etc. to perform the work satisfactorily.

Contractor shall prepare detailed procedures for piping, dewatering, swabbing, pigging & commissioning of the pipeline, covering all aspects of work for owner's approval.

Contractors shall design & supply all temporary line connections Valves, Instruments, as required during the various operations.

In the event of any details which are not fully addressed, it is warranted by Contractor that work shall be performed in accordance with the specification & the best recognized practices in the onshore pipeline industry.

3.0 RESPONSIBILITY OF CONTRACTOR

The pipeline contractor shall be responsible for all the pre-commissioning and commissioning activities that need to be carried out for the project.

3.1 Pre-commissioning

In order to execute and perform pre-commissioning activities, the pipeline contractor shall be responsible for (but not limited to) the following: -

- Carrying out pre-commissioning checks of the pipeline system including Tap-off Stations/Receipt Stations, Sectionalizing Valve (SV) Stations and their associated facilities under the scope of work to ascertain that the project has been mechanically completed in all respects.
- Checking of field instruments, laying out survey of pipeline, checking of communication system, checking of Electrical, Instrumentation system, controls & interlock etc.
- Dewatering of Pipeline and above ground piping, flushing/air-blowing and leak testing of piping i.e. piping and equipments under their scope of work.
- Supply and supervision of manpower for pre-commissioning.
- Operation of machinery and equipment for pre-commissioning.
- Supply and use of materials/consumables as required for the pre-commissioning activities.

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- Erection of all temporary facilities like pig launcher/receiver, line connections, spool pieces, pigs and requisite accessories, valves, instruments, manpower etc. as required during various operations.
- Preparation of detailed pre-commissioning procedures, activity schedules, bar charts, schemes etc.

  This shall include preparation of detailed procedures for dewatering, electronic geometric pigging / caliper pigging (By other Contractor), idle time preservation (if applicable), removal of idle time preservers (if applicable, flushing/blowing, leak testing and shall address the sequence and methodology describing all operations, data on materials, equipments, instruments, consumables (e.g. Pigs and associated items), communication systems, necessary calculations, detailed time schedule and organization chart.
- All necessary work to perform the job successfully including all modifications that would be required at various stages.

The pipeline contractor shall demonstrate to the Owner / Consultant (for approval) the successful completion of all the above-mentioned activities.

In the event of any detail, which is not fully addressed, the pipeline contractor should warrant that work shall be performed in accordance with the relevant codes, Owner / Consultant's specifications and the best recognized engineering guidelines and practices being followed in the on-shore gas pipeline industry.

3.2 Commissioning

In order to execute and perform commissioning related activities, the pipeline contractor shall be responsible for providing all support/ assistance required for commissioning under the overall guidance and supervision of Owner / Consultant. Contractor shall submit a detailed commissioning procedure for Owner / Consultant approval.

The pipeline contractor shall be also responsible to coordinate with the Composite Contractor(s), who is responsible for commissioning of the cathodic protection of the entire pipeline so that the commissioning process can proceed uninterruptedly in a harmonious manner for the entire project.

Commissioning assistance broadly covers the following activities:

- Commissioning checks including Safety Review prior to start of commissioning activities to achieve 'Ready for commissioning' status for pipeline
- Surveillance of pipeline and attending leaks and operation of SVs and metering station (at Dispatch Station/Tap-Off Station/Receipt Stations, IDS whenever required).
- Supply and supervision of manpower for commissioning. Manning of SV and Tap-Off Station/Receipt Stations for pig tracking, pig receiving and other activities.
- Supply and operation of machinery and equipment for commissioning, if required.
- Supply of Nitrogen and its associated accessories for purging required for carrying out commissioning.
- Supply and use of materials/consumables as required for the commissioning activities.

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- Any other assistance required by Owner / Consultant.
- Erection and supply of all temporary line connections, spool pieces, strainers, valves, instruments, manpower etc. as required during various operations.
- Ensuring all communication facilities is in place and in proper working condition prior to start of commissioning activities of the pipeline system.
- Stabilization and total system operation for 72 hrs. with all instruments controls & interlocks working satisfactorily at normal operating conditions. On completion of this stage one-month operating run period will start.
- All necessary work to perform the job successfully including all modifications that would be required.

In the event of any detail, which is not fully addressed, contractor should warrant that work should be performed in accordance with the relevant codes, Owner's specifications and the best recognized engineering guidelines and practices being followed in the onshore pipeline industry.

3.3 Pre-commissioning Activities

3.3.1 PRE-COMMISSIONING CHECKS

Pre-commissioning checks shall be carried out for the pipeline system to ascertain that the pipeline system has been mechanically completed in all respect. These checks shall cover all the facilities of the main pipeline, including Metering Stations, tap-Off Stations, Receipt Stations, Sectionalizing Valve Stations, as applicable. The pre-commissioning checks shall include the following:

a) System Checks

The entire facilities shall be checked against the latest P&ID's, Engineering and Vendor Drawings/Documents and other design specifications. Any shortcoming observed shall be listed down in the form of punch lists and these should be duly attended or liquidated. The pipeline contractor should check the stations systems from the angle of pre-commissioning and commissioning and spell out any additional requirement of vents/drains, temporary arrangement/modification etc. that may be required during the pre-commissioning and commissioning activities and arrange for the same in consultation with the Owner / Consultant representative.

b) Checking of Field Instrument

All the field instruments like actuated valves, shutdown valves, transmitters, solenoid valves, shut down switches, alarms etc. shall be checked physically and also for their intended application by simulating the actual conditions. It will also include checking of different meters, gauges, action of actuated valves, control valves, shutdown valves etc.

c) Survey of the Pipelines

This shall be performed to confirm that proper fittings/ supports, Cathodic protection system, route markers, warning signs, fencing around SV stations, etc. have been installed along the pipeline.

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d) Checking of Communication System

This is to check that there is proper communication with adequate back-up power to ensure uninterrupted communication.

e) Checking of Electrical Distribution System

This is to ensure safety and also to ensure an uninterrupted power supply during start-up and normal pipeline operation.

f) Checking of Instrument, controls & Interlocks

This is to check that instrument controls and interlocks are functional as per the normal operating conditions.

g) Checking of Utilities

This is to check that utilities like power system, etc. are available prior to start-up.

h) Any other checks as may be considered necessary.

3.3.2 PRE-COMMISSIONING WORKS FOR THE ABOVE GROUND PIPING/ UG PIPELINE (DISPATCH STATION, METERING STATIONS, RECEIPT STATIONS ETC. UNDER THE SCOPE OF WORK)

3.3.2.1 Dewatering (Hydro Test Water)

- General

  Dewatering of a piping system shall be done subsequent to the hydro-test of the respective piping section. During the dewatering operation, the major quantity (to the maximum extent possible) of hydro-test water shall be removed from the main interconnecting piping work in the stations. A standard blind shall be arranged and provided at the inlet and outlet nozzles of pumps and sump tank to avoid entry of debris/dirt/mud etc., before start-up of pre-commissioning activities.

- Operational Requirements

  The dewatering operation of the piping work in the stations shall consist of physically draining the water content in the piping work by opening low point drains and/or end flanges. If required, air shall be used to push-off water from the pipes. The pipeline contractor shall arrange suitable compressor for such purposes.

- Flushing/Blowing of Aboveground Piping in the Terminal

  Flushing/blowing of the above ground piping with water/air to remove debris/dirt/mud from within the piping has to be performed by the pipeline contractor. Subsequent to water flushing, to ensure complete cleanliness of the piping work, air blowing/cardboard blasting method has to be adopted. All instruments, control valves, orifice plates etc. to be dismantled from the piping work and any gap produced should be bridged with suitable temporary spool. Proper supporting of the piping, during such flushing/blowing activities is to be ensured by the pipeline contractor.

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The pipeline contractor has to make arrangement of clean water/air for these flushing / blowing activities.

The pipeline contractor should submit a plan/methodology for carrying out such activities detailing out each aspect/step.

- Acceptance Criteria

The pipeline contractor shall specify when flushing/air blowing is completed to the satisfaction of the Owner/Consultant, and shall obtain approval of the Owner/Consultant before proceeding to the next step.

Pipeline

The pipeline contractor has to dewater the pipeline section after hydrotest. After dewatering, swabbing shall be done.

The pipeline contractor should submit a plan/methodology for carrying out such activities detailing out each aspect/ step for review & Approval of Client /EIC/PMC.

The disposal of the water shall be performed such a way that no harm is done to the environment and animals and the Dewatering procedure should indicate this disposal methodology.

3.3.2.2 Swabbing

The swabbing operation, which shall be done subsequent to the dewatering operation, is meant to reduce the remaining water in the pipeline to acceptable condition and to ensure removal of free water left inside the pipeline prior to final drying/ purging and commissioning of the Pipeline system. This is done by driving number of foam pigs propelled by oil free compressed dry air, which can pick up free water in the pipeline.

- Acceptance Criteria

It is recommended that before foam pig run, number of batch pig run shall be done to minimize free water in the pipeline section. Then only foam pig run shall be started. Dewatering is considered as complete, when foam pig received is in touch dry condition & same is subjected approval of Client /EIC/PMC.

Dewatering & Swabbing procedure shall be submitted for review & approval of Client /EIC/PMC.

Contractor shall obtain approval of the Owner/ Consultant before proceeding to the next step.

3.3.2.3 Drying

The pipeline system including the underground pipeline and the above ground piping at dispatch and receipt stations, SV stations, all Terminal station, CGS/ PRS stations and hook-up / tap-of points needs to be dried prior to charging natural gas if specified in bid. Drying is required to prevent internal corrosion of the pipeline & to meet the supply specification and also as a means of preservation of the pipeline sections subsequent to the pre-commissioning activities. The pipeline shall be dried by using super dry air / vacuum method or by any other suitable method.

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Contractor shall submit the detailed procedure and the duration of the drying operation and obtain Company's approval on the same prior to start of the drying operation.

Commissioning contractor shall assess any requirement of swabbing for entire pipeline to reduce the time for drying and shall carryout such activity.

- Acceptance Criteria

  Contractor shall ensure that drying operation is complete before proceeding to the next step of inertization/ purging. The drying of the pipeline system shall be considered to be achieved on attaining a water dew point of -8°C at atmospheric pressure and this water dew point in pipeline shall be continuously maintained till inertisation or commissioning of the pipeline.

3.3.2.4 Internal Cleaning of Equipment

- General

  Equipments like filters, Corrosion Inhibitor Dosing Tanks, Sump Tanks are to be checked for internal cleanliness and shall be ensured by the pipeline contractor.

- Acceptance Criteria

  The laying contractor has to demonstrate cleanliness of the internals of all equipment to the satisfaction of the Owner/Consultant and obtain approval for final box up of the equipment.

3.3.2.5 After dewatering / swabbing is over & all functional checks carried out as specified in pre-commissioning checks, drying of the pipeline is to be closed out with compressed air. The pipeline shall be dried to achieve a content dew point of -8 Deg C.

3.3.2.4 Trial Run of Rotating Equipments

The pipeline contractor has to arrange for trial run of the sump pump with water for short duration of time.

The pipeline contractor has to arrange all temporary arrangements required for such trial runs. The pipeline contractor has to submit procedure/method statement regarding how he plans to take such trial runs and take approval of the Owner/Consultant, before actually proceeding for the same. If pump vendor(s) is available for such trial run, the pipeline contractor has to provide all sorts of assistance to the vendor and help the vendor in completing the successful trial run.

3.4 Commissioning Related Activities

3.4.1 Safety Review Prior to Start of Commissioning Activities

A pre-start-up safety review of the cross-country pipeline system shall be arranged by the pipeline contractor, involving all concerned in the commissioning. The Owner/Consultant shall also participate in the pre-start-up safety review. The pipeline contractor shall generate all requisite formats to record the findings of such Safety Review.

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3.4.2 Ready for Commissioning

After completion of pre-commissioning activities and Owner approved safety start-up review followed by liquidation of review punch list points, the pipeline contractor shall notify the Owner/Consultant that the pipeline systems in totality are ready in all respects for hydrocarbon-in. 'Ready for commissioning status' shall be jointly assessed by Owner/Consultant, composite work contractor, Pipeline contractor. After such joint assessment, if all the criteria are met, it will then be declared by the Owner that the entire pipeline system has reached a stage of 'Ready for Commissioning'.

Inertization/ Purging

Contractor shall carry out Inertization/ Purging of the entire pipeline system including the underground pipeline and the above ground piping at dispatch and receipt stations, SV stations, IP stations and hook-up / tap-of points).

Operational requirements:

During the Inertization/ Purging operation, the dry air left in all the pipeline shall be replaced by dry nitrogen before filling the natural gas into the pipeline for safe commissioning. Depending on the commissioning plan/ strategy, sections of the pipeline system may be taken up for commissioning in steps. One of the suggested methods for Inertization/ Purging of the underground pipeline is by the usage of nitrogen slugs separated by pigs. Depending on the length of the pipeline portion to be taken up for commissioning, the amount of the nitrogen use may vary. In general, the total volume of the nitrogen slug train must be at least 10% (by volume) of the total length of the pipeline under consideration. The last pig in the pig train shall be propelled by natural gas (during commissioning stage of the pipeline).

For above ground piping at dispatch and receipt stations, SV stations, IP stations and hook-up / tap-of points, the piping shall be purged with nitrogen

Nitrogen required for Inertization/ purging purpose of the pipeline and aboveground piping shall be supplied by the contractor and should be of purity level 99.9% or above. Nitrogen gas at ambient temperatures (AND NOT LIQUID NITROGEN) and in completely vaporized and gaseous state shall be used as the Inertizing medium. In case, the source of gaseous nitrogen is from liquid nitrogen tankers, then all precautions (including verification of the lowest tolerable temperature of all components in the system under commissioning) should be ensured. All temporary connections required for nitrogen purging shall be done by contractor.

The contractor shall submit the detailed procedure (in line with the above suggested method or any other acceptable one) and the duration of the Inertization/ Purging operation and obtain approval of the company before starting the operation. Inertization/ Purging shall be followed immediately by charging of pipeline by natural gas.

- Acceptance Criteria

Inertization of the entire pipeline may be accepted to be complete when the required quantity of nitrogen has been introduced into the pipeline. The contractor has to ensure this condition for safe commissioning of the pipeline. For above ground piping at dispatch and receipt stations, SV stations, IP stations and hook-up / tap- of points, the inertization

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may be accepted to be complete when the residual oxygen content in the piping is below 1% (vol/vol).

3.4.3 Commissioning and Pressure Stabilization

The pipeline contractor shall be responsible for providing all necessary assistance to carry out commissioning activities under the overall guidance and supervision of Owner/Consultant for the entire pipeline system.

Pipeline shall be commissioned and stabilized in 2 phase, i.e. up to 5 kg/cm2 g pressure and then up to operation pressure. Pipeline shall be kept for 24 hours after Ist phase for pressure stabilization.

Low Pressure leak check for aboveground piping

- General

The aboveground piping sections of the pipeline system shall be checked for leaks at flange points of piping and equipment, instrument impulse tubing points etc. This shall be done by pressurizing the system piping / equipment with dry compressed air (for this purpose, oil free air compressors shall be used) and testing the system by means of soap solution for leaks.

The contractor shall submit the detailed procedure and the duration of the leak check operations and obtain approval of the company before starting the operation.

- Acceptance Criteria

The leak check operation shall be considered to be completed when the piping system / equipment is free of leaks, after equipment pressure stabilization. This shall be subject to Company's approval.

Commissioning of pipeline shall be considered completed when the line is charged with product natural gas at operating pressure and the total system operated at normal operating pressure for a minimum period of 72 hrs. with all the instruments, controls & interlock satisfactorily at normal operating conditions. Contractor shall submit a detailed commissioning procedure for owner's approval.

3.5 Commissioning Check List

Check list to be filled up for commissioning approval of the pipeline:

S. NO.	GENERAL INFORMATION	OBSERVATION/ COMMENTS		
		CONTRACTOR	CONSULTANT	CLIENT
a. GENERAL				
1	a) Name of the Pipeline : b) Services (NG) c) Design/ OISD code followed : d) Design capacity : e) Length of the Pipeline in kms:			

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	f) Size - Outside Dia. / Wall Thickness / Grade of Pipeline : g) Is the pipeline designed for scrapper / intelligent pigging? h) No. & location of isolation Valve(s) with chainages : (i) Hand Operated valves (ii) Remote Operated valves i) No. of water bodies crossings with Chainages : (i) Name of River (ii) Pond / Lake crossings (iii) Canal crossings (iv) Marshy land / creek j) No. of cased crossings Railway k) No of Road crossings (NH & SH) i) Cased ii) Non cased			
b. CROSS COUNTRY PIPELINE DETAILS				
1	Design pressure of the pipeline (In Kg/Cm2).			
2	Maximum allowable operating pressure of the pipeline, and normal Operating Pressure (In Kg/Cm2).			
3	Corrosion allowance for the pipeline. (In mm)			
4	Whether the pipeline has been hydrostatically tested. (i) Hydrotest Pressure (In Kg/Cm2) (ii) Period of Hold			
5	Type of Sectionalizing Valves used on the pipeline.			
6	Whether the pigging facility has been installed and the pipeline is piggable by scraper pig.			

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7	Whether the gauging pig was passed through the pipeline to prove its internal diameter and was it satisfactory.			
8	Whether EGP was carried out for the pipeline. Details to be provided.			
9	Whether the pipeline has been cleaned and swabbed.			
10	Whether adequate product is available for commissioning.			
11	Whether mechanical completion report for the pipeline is available.			
12	Whether ROU restoration completed.			
13	Whether following approvals have been obtained for pipeline before construction? - PESO (CCOE) approval for laying of pipeline/ construction of facilities. - State Pollution Control Board consent to establishment. - Registration of establishment from Central/ State Govt. labour commissioner under Contract Labour (Regulation and Abolition) Act'1970. - Permission from Irrigation/ PWD authority/ NHA etc.			
14	Whether following Clearances obtained before Commissioning? - Commissioning clearances from PESO (CCOE). - CCOE License as required. - Consent for operation from state pollution control board for Air and Water. - Factory License as required.			
15	Whether pre-tested Insurance Stock pipes earmarked and kept separately.			
COATING AND CATHODIC PROTECTION DETAILS				

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1	Type of External Coating used in the Pipeline (CTE/ 3LPE/ FBE/ Other) Coating (Thickness in mm).			
2	Whether the pipeline is adequately protected cathodically: Presently protected by TCP. Expected date of Commencing of PCP.			
3	Post Construction Coating Survey carried out or not?			
4	Whether Interference survey for the pipeline has been carried out carried out and mitigation measures taken.			
5	Whether electrical Surge diverter provided across IJs?			
6	Whether corrosion coupons have been installed for internal corrosion monitoring ?			
7	Whether all cased crossings have been checked and are free from any electrical shorting.			
8	Whether Natural PSP of the Pipeline has been taken?			
c. STATION PIPING				
1	Whether station piping has been provided as per the latest approved P&IDs.			
2	Whether mechanical completion certificate for the station is issued			
3	Whether all the flange connections have been checked for tightness and length of bolts are adequate. **All short bolting have been checked?**			
4	Whether flow direction has been marked on station piping and equipment.			
5	Whether proper direction for check valves and flow meters has been ensured.			

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6	Whether adequate crossovers for crossing and platforms to operate valves have been provided **with safety hand rails?**			
7	Whether access to all operating equipment's including vessels, valves, sump pump, scraper barrel is adequate.			
8	Whether CI dosing facilities with adequate stock is available for dosing in water and product.			
9	Whether proper arrangement has been made for drainage and disposal of the water during commissioning.			
10	Whether alignment of motor with main pump/ compressor and suction/ discharge piping is done and acceptable to the vendor/ owner.			
11	***MOVs which are on remote operation have been functionally tested for opening and closing operation?***			
12	***Whether Vent lines have been provided as per code/ standard/ specifications.***			
MISCELLANEOUS				
1	Power System Details: i) Transformer Rating & Type ii) HT Breaker Type & Rating iii) DG Set's Details			
2	Communication system details: i) Telephones ii) PA/Paging iii) VHF iv) Walkie/ Talkie v) Hot Line vi) VCS vii) CCTV			

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3	Whether firefighting equipment are provided as per code/ standard/ specifications.			
4	Whether list of contact persons has been displayed with telephone nos.			
5	Check availability of Visitor/ attendance Registers at the gate.			
STATUTORY APPROVALS				
1	Whether following approvals have been obtained for construction. - PESO (CCOE) approval for construction of facilities (Ref no. and Date). - Environmental clearance for the project (No. & date) - Pollution control.			
2	Whether following licenses/ approvals are available before commissioning: - CCOE License No., date, validity. - Is there any change with respect to approved CCOE layout? - NOC from District Magistrate/ District Collector in case CCOE License is not applicable - Govt. Notification for protected area declaration - Clearance from CEA/ State Electrical Inspectorate. - DG Set Installation approval - Any other applicable statutory license/ approval			

4.0 DOCUMENTATION

The pipeline contractor shall submit the complete description, detailed procedures and time schedule for all of the following activities for approval of the Owner/Consultant.

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- Pre-commissioning Checks
- Dewatering
- Swabbing
- Flushing / Blowing
- Low Pressure Leak Test with Air
- Drying
- Idle Time Preservation (if applicable), including Removal of Preservers

All these documents should be prepared covering all aspects of HSE, quality assurance and quality control plans.

The pipeline contractor shall ensure that his documents are related to "as-built" conditions of the pipeline, equipment and structures involved.

Documents shall also contain all safety plans, procedures to be followed while carrying out the activities.

Upon successful completion of the work, the pipeline contractor shall prepare a final report of the work which shall include necessary charts, diagrams, graphs, calculations, recordings, daily logs, measurements, details of the operation etc. Report shall also include all certificates of calibration of instruments required, together with records of calibration performed at site prior to the start of any operation and the approved pre-commissioning and commissioning formats and check sheets.

5.0 SPARES AND CONSUMABLES

The pipeline contractor shall identify and arrange for supply of manpower, spares, tools, tackles and consumables as required for pre-commissioning and commissioning activities.

6.0 SAFETY

The pipeline contractor shall follow the safety practices during execution of pre-commissioning and commissioning works as detailed in the scope of work. The pipeline contractor shall also maintain and follow all safety practices equivalent or better than those being practiced by the industry during pre-commissioning and commissioning activities. A dedicated safety department from the pipeline contractor's side should be available for the job.

7.0 OTHERS

The pipeline contractor, along with his bid documents, is required to submit the following:

- Execution plan and method statement for pre-commissioning and commissioning activities.

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- Past experience of pre-commissioning and commissioning activities carried out for a similar pipeline system / network.

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STANDARD SPECIFICATION

FOR

MAGNETIC CLEANING AND ELECTRONIC GEOMETRY PIGGING

VPC-SS-PP-2026

01	28.01.2020	MB	MC	AD	SK
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PART I: SCOPE OF WORK

1.0 OBJECTIVE

The objective of the present survey is to clean "constructional metallic debris" of the pipeline and obtain the record of internal geometry in "As laid" condition of the pipeline. It is therefore required to run the magnetic cleaning pig and Electronic Geometry Pig so as to identify, characterize (Sizing and Location), and evaluate any geometrical injurious defects that might have got introduced during installation.

2.0 SCOPE OF WORK

Essentially the Scope of Work comprises of running the Magnetic Cleaning Pig and Electronic Geometry Pig through each segment of the pipeline.
All facilities /services numerated below (not limited to) which the CONTRACTOR deems necessary to fulfil the WORK shall have to be arranged by him at no extra cost and time to the COMPANY.

Pipeline laying contractor shall carry out the cleaning and gauging operation. However for satisfaction of EGP contractor, to get the interpretable data, if any more cleaning is required he shall do the same without any time and cost implication to the company.

2.1 <u>Activities</u>:

(a) Mobilization of all equipment e.g. Magnet cleaning pigs, Electronic Geometry pigs, pig locating and pig tracking devices, spares, consumables, Communication system, transportation and personnel. It is expressly understood that this does not limit the scope of work of the CONTRACTOR in any way. The quantities to be mobilized for different equipment (different types of pigs, pig tracking device) accessories, spares, and consumables need to be carefully evaluated by the bidder taking in to the consideration that Cleaning and Geometry inspection should be carried out without any constraint. CONTRACTOR is to mobilize all types of required pigs, accessories, spares, pig locating and tracking devices, in adequate number for completion of entire works within the contract price without depending turnaround time of bringing the pig received from previous run from receive station to launch station. As such no turn around period shall be allowed. Contractor shall submit operation manual/procedure manual and data sheets for pigs before commencing the job for OWNER/CONSULTANT approval.

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(b) Carrying out adequate number of Magnet cleaning pig runs by running suitable Magnet cleaning pigs in pipeline/ pipeline segment covered under SCOPE OF WORK including pig tracking till such time CONTRACTOR is satisfied with himself about the degree of cleanliness of pipeline/Pipeline Segment segment and provide detailed daily site report for each run in the approved format before commencing the subsequent run.

However, the constructional ferrous debris permitted with magnetic cleaning pig shall not exceed 5 Kg/100KM. In case debris received is more than this amount, the contractor shall be required to make subsequent run(s) until at least the above limit is achieved.

(c) CONTRACTOR to carry out adequate number of electronic geometry (Electronic Geometry) pig runs in each pipeline segment covered under SCOPE OF WORK including pig tracking for each pipeline segment to generate valid and interpretable geometry data of the pipeline and analysis of data of the Electronic Geometry survey to detect the nature, extent and location of geometry defect as detailed in Para 3.0 Part-II Technical Specifications. Contractor to provide detailed daily site report for each run in the approved format before commencing the subsequent run. The tool should be capable of inspecting entire length of the pipeline segment i. e. from launcher to receiver in a single run. Battery life should be adequate and commensurate with the run time required travelling the pipeline length. The electronic recorder system should have requisite data storage capacity. The drive cups should have requisite resistance to wear and tear to maintain effective seal throughout the entire run time.

The measurement shall cover the entire 360° of internal pipe wall circumference using properly oriented and sufficient quantity of sensors.

(d) Demobilization of all equipment, tools and personnel on completion of field activities for all segments.

(e) Final data analysis of the Geometry Inspection record at the Contractor's data analysis center. The analysis shall consist minimum of following: -

- Defect sizing (Depth & length) for all "significant defects" (Deformation >= 2% of ID).
- Identification of all pipeline permanent features e.g. valves, tees etc.

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- Identification of potentially hazardous defects likely to affect structural integrity of the pipeline.

- Preparation of final processed inspection logs and preparation of complete WORK report giving interpretation of the inspection logs and giving defect sizing.
- The CONTRACTOR will transfer all the processed data generated on a CD with user-friendly operation on a compatible PC.

- Providing all the raw and processed data along with the software package for enabling COMPANY/CONSULTANT to study the data as required. The software should be user friendly.

(f) **BACK UP SERVICES**

The bidders are free to avail back up services from any international pigging company of repute for specialized services including special pigs, personnel, data analysis etc. However, the bidder in his bid shall clearly mention the name, address, contact person, telephone, fax, e-mail etc. of the company whose services are proposed to be availed by the bidder. Bidder to note that the main bidder shall be responsible for the entire SCOPE OF WORK in conformity with all provisions of the tender document.

2.2 PROPELLING MEDIUM

Since pipeline is not commissioned, contractor shall use compressed air as propelling medium for which single compressor of 900 cfm capacity shall be used. The compressor should have the capacity to develop pressure upto 10KG/CM^2. Contractor shall also keep one compressor of the same capacity mentioned above as stand by. However, Contractor should mobilise higher capacity compressors in order to complete the magnetic cleaning and electronic geometry inspection to meet any contingency like stuck up pig/ early completion of pigging work. Contractor has to arrange all the facilities required for pressurizing air into the pipeline and running the pigs at required speed so that valid and interpretable data by running Electronic Geometry pig is generated by using the above media.

2.3 DEFECT VERIFICATION

At the discretion of the COMPANY/CONSULTANT Identify at least two verification dig sites (In case SIGNIFICANT defects are detected during Electronic Geometry Pigging) for each pipeline segment jointly with owner from the recorded data and provide VCS/owner defect

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sheet indicating distance from the nearest pipeline feature or reference marker to facilitate location of defect in the field.

The contractor shall depute his representative to observe the verification at verification sites for proving that field log detected anomalies conform to sizing, including linear positions.

2.4 FINAL WORK REPORT

The final work report shall be for each segment including Magnet Cleaning and Electronic Geometry pig runs details with operational and functional parameters, daily detailed site report of each run with observations, individual feature report, velocity plot of Electronic Geometry pig, etc as detailed out at Para 7.0. of part II.

3.0 PIG TRACKING

The movement of any type of pig put into the pipeline during Magnetic cleaning and Electronic Geometry Pigging shall be required to be monitored along the pipeline length from launcher to receiver trap. The BIDDER shall detail out the complete methodology of pig tracking proposed to be deployed by him including complete technical details of the equipment and device proposed to be used for this purpose.

It is proposed that pig tracking would be done in a discrete manner at least 2 to 10 KM intervals on each pipeline segment at preselected locations. The exact KM chainage of these locations shall be decided at site in consultation with the CONTRACTOR and CONSULTANT/COMPANY.

4.0 ABNORMAL SITUATIONS:

The objective of this section is to write down foreseeable abnormal circumstances for taking appropriate measures, should such a condition arise during implementation of Project.

The COMPANY has foreseen the following abnormal conditions. However, if the BIDDER foresees any other abnormal condition, he is free to make a mention of the same in his technical BID offer:

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4.1 TOOL FAILURE

CONTRACTOR is required to get valid interpretable and verifiable data for each segment of the pipeline. In case CONTRACTOR'S equipment fails to perform electronic geometry inspection to generate valid data for any of the pipeline segment, CONTRACTOR will make extra runs to get valid and physically verifiable data without any additional cost and time implication to the company.

4.2 STUCK-UP TOOL

The BIDDER shall detail out a contingency plan in his BID as proposed by him in case any of the pigs get stuck up. The plan shall identify procedure for exactly locating the stuck up pig, detail procedure for retrieval of pig, equipment, including support facilities required to retrieve the pig.

If Pig does not move from stuck up location, by any measure, then the pipeline section shall have to be cut for retrieval of Pig. Necessary fabrication and modification of pipe with new pipe piece after retrieval of pig shall be done by Contractor at no extra cost to the OWNER. Locating the stuckup pig and its retrieval shall be responsibility of the contractor. After modification pigging Contractor shall run Gauge pig to check internal restriction, if any.

5.0 MISMATCH OF INSPECTION RESULTS WITH ACTUAL DEFECTS DURING SITE VERIFICATION:

- In case of variance between the results of physical defect verification and the results reported by the contractor on the basis of Electronic Geometry survey (after considering the tolerance as provided in the contract) segments, this shall be considered as a failed run and shall be dealt as per Cl.4.1 above.

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PART II TECHNICAL SPECIFICATIONS

1.0 INTENT

The intent of the specification is to set-forth the requirements of the Electronic Geometry Survey of the pipelines to help bidder quote his unit rate price in the schedule of rates.

This requirement is not intended to be all inclusive and use of guidelines set-forth does not relieve the contractor of his responsibility of successfully carry out all activities and to obtain reliable and valid data from the EGP tool about condition of the pipeline as defined under Scope of work.

2.0 MAGNET CLEANING PIG RUNS

Prior to launching of Electronic Geometry pig, contractor shall complete all activities required to establish adequate cleanliness of pipeline to the satisfaction of the contractor and to verify the internal geometry of the pipeline with relation to ovality, dent etc. Contractor shall decide the number of Magnet cleaning pig runs and the choice of the Magnet cleaning pig for each cleaning run as suitable for the purpose to obtain internal condition adequately clean so as to obtain valid and interpretable inspection data from the Electronic Geometry pig and to safeguard Electronic Geometry pig against damage due to debris as detailed out at Para 2.1(c) Part-I Scope of Work and Technical Specifications.

The cleaning pigs for successive cleaning pig runs shall be selected by the contractor in such a manner that effective cleaning i.e. 5kg/100km ferrous debris is achieved. The detailed specifications of Magnet cleaning pig shall be furnished in the offer.

3.0 ELECTRONIC GEOMETRY PIG RUNS

The Electronic Geometry pig should be capable of recording the entire length of each segment i. e. from launcher to receiver in one single run and therefore its electronic recorder system should have requisite data storage capacity. Battery life therefore should be adequate to commensurate with the run time required to travel the pipe length of each segment and the drive cups should have requisite resistance to wear and tear to maintain effective sealing throughout the entire run time. Bidder to furnish a calibration certificate for EGP prior to mobilization of equipment. OWNER reserves the right of witnessing calibration test at Contractors designated location at Owner’s expenses.

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The measurement shall cover the entire 360° of internal pipe wall circumference using properly oriented and sufficient no of sensors. The tool shall be capable to identify and locate the following features as a minimum.

- Individual Girth weld
- Dent, ovality, buckles, or any other out of roundness, change in pipeline I.D. and difference of thickness.

BIDDER to supplement the following information in his BID. so that same can be checked w.r.t the parameters given in Para 4.0 below as required.

a. Accuracy of locating indication/I.D. Reduction w.r.t to axial length (Meters).

b. Max. % Of Nominal pipeline ID tool can pass (% ID)

c. Minimum deformation level Reported (as % of ID)

d. Accuracy of Measurement (% of ID)

e. Bend radius tool able to negotiate

4.0 DEFECT SIGNIFICANCE

The following information/performance is expected out of the Electronic Geometry pig inspection:

4.1 Inspection of entire length of each segment to be completed in one single run.

4.2 Accuracy of defects:

The best accuracy offered and guaranteed by the BIDDER for each category of defect should be clearly spelt out. However, the tool should have minimum capabilities as under.

Minimum Detection level for dent: 2% of ID

Sizing Accuracy for dent: +0% of ID, -25%of measured value

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Minimum detection level for Ovality: 5% of ID

Sizing Accuracy for Ovality: +/- 1% of ID

Location Accuracy Axial: 0.1% from Permanent Features.
The tool should be capable of negotiating minimum 3D bend and 15%reduction in Pipe ID.

5.0 MAX RUN LENGTH OF LIVE TOOL:

The BIDDER must specify in his offer the max. Length which can be inspected in one single continuous run by the tool proposed by him. It is required to complete the entire run length of each segment of the pipeline in a single run. The length of each pigging segment shall be based on the length of hydro testing of the pipeline. However, length of pigging segment up to 70 Km shall be acceptable.

6.0 DATA ANALYSIS:

Bidder shall carry out the data analysis for EGP. BIDDER shall provide all raw and processed data and his software package along with his compatible hardware. The software package shall be user friendly. It should provide full capability for data study.

7.0 FINAL WORK REPORT

The BIDDER shall include in his offer the most appropriate reporting procedure envisaged for the subject pipeline. This will have to be mutually agreed between the successful bidder and consultant/company.

However, any reporting system shall include but not limited to the following:

- A detailed report in respect of each pipe segment of running each of the pre-inspection tools such as Magnet cleaning pig.

- Detailed report about running of the Electronic Geometry pig including but not limited to the operational and functional details. Details describing the type, size and location of individual mechanical defects. The location of each defect should be suitably listed with reference to permanent pipeline features, girth weld no., relative and absolute distance.

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- A detailed report in respect of each defect for which sizing has to be done indicating its length, depth and axial location suitably referenced.

- Preliminary site report for each pipe segment for each running of Magnet cleaning, and Electronic Geometry pig runs stating comments/observations of each run, pig condition, operating parameters, and total time required.

- Velocity plot of the Electronic Geometry pig along the length of the segment.

The format and Performa of the above report shall be mutually agreed upon between the successful BIDDER and CONSULTANT/COMPANY.
All the data generated by the CONTRACTOR shall be compiled in CD having user-friendly operation on a Compatible PC along with the software necessary for review/analysis of data. This is required to facilitate selection of significant defects, their chainage and sizing. CONTRACTOR will furnish this floppy disk and CD as part of report.

8.0 BID EVALUATION CRITERIA (TECHNICAL)

Bidder should satisfy the entire following technical and past experience requirement, failing which their Bids summarily rejected and shall not be considered for technical evaluation. Bidder should submit documentary evidence to substantiate his claim for his past experience in the form of work order/ completion certificate.

- Bidder should have carried out satisfactory electronic geometry pigging (Caliper pigging) of pipeline of diameter 16"or above for at least 50 km single continuous length during last five years.

- Bidder should have completed at least 700 Km cumulative length of pipeline inspection by electronic geometry pigging (Caliper pigging) tool in single or combination of 8”and/or above pipeline dia in last ten years.

- Bidder should have full-fledged calibration and testing facility for Electronic Geometry Pig tool including test loop of similar size and data interpretation facilities.

- Bidder's proposed tool should be capable of detecting minimum 2% of ID dents.

- Bidder should own the proposed tool.

9.0 INFORMATION TO BE FURNISHED BY BIDDER IN HIS OFFER FOR EVALUATION

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- If bidder proposes to engage back up agency then scope of work and responsibility of back up agency shall be furnished.

- Specifications of Magnet cleaning pigs and Electronic Geometry pig for required pipe sizes.

- Details of Electronic Geometry pig in following respect.

  Max.% of Nominal pipeline ID tool can pass(% of ID)

  Minimum deformation level reported (as % of ID)

  Accuracy of measurement (% of ID)

  Bend radius tool able to negotiate

- Details of pig tracking equipment and pig tracking procedure.
- Pig stuck contingency plan.

- Proposed methodology for execution of pipeline pigging.

- Methodology of Work

- Schedule of work

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STANDARD SPECIFICATION

FOR

REPAIR OF POLYTHYLENE COATING

VPC – SS – PP -2027

01	28.01.2020	MB	MD	AD	SK
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ABBREVIATIONS:

DC	:	Direct Current
EN	:	European Standard
KV	:	Kilo Volt

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1.0 SCOPE

This specification covers the minimum requirements for materials and equipment, application procedure and inspection of repair of damaged Polyethylene coatings on steel pipes. This specification is applicable for repairing damages less than 100mm x 100 mm for pipe sizes less than 10", 150mm x 150mm for pipe sizes between 12" to 28" and 300mm x 300mm for pipe sizes more than 28".

If damaged area of coating of the pipeline is larger than above, heat shrinkable sleeve is recommended.

The repair shall be carried out using repair patch made of radiation cross-linked polyolefin backing, coated on the inside with semi-crystalline thermoplastic adhesive and filler mastic.

The repair patch shall have thermal indicators to ensure correct heat is being applied during application.

2.0 MATERIAL AND EQUIPMENT

2.1 The repair material shall be as under:

a) Repair Patch: radiation cross-linked HDPE (Unexpanded High density polyethylene) with semi-crystalline thermoplastic adhesive.

b) Mastic Filler

c) Melt stick shall be Co-Polymer based and same shall be heat sensitive.

d) Liquid Epoxy Primer (two pack)

2.2 The repair material shall be certified by DIN to meet the requirements of EN12068 Stress Class CHT 80

2.3 The material shall not be older than their period of validity at the time of application by the Contractor. Deteriorated/decomposed materials shall not be used.

2.4 Materials shall be stored in sheltered storages in the manufacturer's original packing away from direct sunlight and in accordance with manufacturer's instructions.

2.5 Contractor shall supply all equipment and manpower required for a skilful application in the field in accordance with the specification.

3.0 APPLICATION PROCEDURE

3.1 The application procedure to be followed for holiday type of damage shall be in accordance with manufacturer's instruction and minimum requirement specified below whichever are the more stringent.

3.1.1 Preparation

Remove coating from damaged area with knife, scraper or power brush. Scrap off the damaged area and adjacent coating to remove oil, grease, rust, dirt and moisture. Pipe surface shall be prepared to SA 2½.

3.1.2 Preheating

Preheat the exposed bare metal surface to approx. 80° C and adjacent pipe coating to approx. 60° C with a torch moved back and forth over the surface. Upon preheating, the

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pipe surface shall be applied with the two pack epoxy primer to ensure a minimum wet film thickness of not less than 200 microns to cover the exposed base metal.

3.1.3 Application of the Filler

Plastic filler shall be cut to size and applied to all exposed metal surface. The mastic shall be heated and smoothed down with a paint scraper to cover all bare metal in a manner such that all entrapped air is removed and mill applied coating thickness of the pipe is restored.

3.1.4 Application of repair tape

A patch shall be cut from the tape in a manner such that it extends 50 mm (2 inch) beyond the damaged area on all sides. The patch shall be positioned over the damaged area and heated until the temperature sensitive paint on the outside of the patch changes colour or dimples on the backing vanish. It shall be smoothed down to confirm with the contour of lap, and shall be freed of any air bubbles or wrinkles.

3.2 For cosmetic type of defects such as minor gouging, tearing, and/or scratches, which do not indicate holiday during holiday inspection, following procedure shall be adopted.

3.2.1 The defective area shall be roughened to remove loose polyethylene coating, oil, grease, dirt, etc.

3.2.2 This shall be followed by application of patch as detailed in clause 3.1.4.

4.0 INSPECTION AND TEST

4.1 A visual inspection shall be carried out for the following:

- Mastic extrusion on ends of the patch shall be examined.
- There shall be no sign of punctures or pinholes or bend failure. The external appearance of the patch shall be smooth, free from dimples, air entrapment or void formation.
- The entire closure patch shall have changed colour uniformly.

4.2 Holiday Inspection

The holiday detector used shall be checked and calibrated daily with an accurate D.C. Voltmeter. The detector electrode shall be in direct contact with the surface of coating to be inspected.

The entire surface of the repaired section shall be inspected by means of a full circle holiday detector approved by Owner set to a D.C. Voltage of at least 25 KV. Inspection of repaired patch shall be conducted only after it has cooled below 50° C.

4.3 Procedure qualification shall be carried out for repair patch. The value for peel strength to pipe surface and to factory coating carried out as per EN 12068 shall be 0.5 N/mm minimum at 60°C.

4.4 All repaired joint shall be approved by the Owner.

5.0 DOCUMENTATION

5.1 Prior to procurement of coating repair materials, Contractor shall furnish four copies of,

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but not limited to, the following for qualification of the Manufacturer and material:

i) Complete descriptive technical catalogs describing the materials offered along with samples of repair coating materials, its properties and installation instruction as applicable specifically to the project.

ii) Test certificate and results of previously conducted tests from independent inspection agency, for properties listed in Para 4.3 of this specification.

iii) Reference list of previous supplies of the similar material indicating the project details such as diameter, quantity, service conditions, year of supply, project name, contact person and feedback on performance.

Once the Company's approval has been given, any change in material or Manufacturer shall be notified to Company, whose approval in writing of all changes shall be obtained before the materials are manufactured.

5.2 Prior to shipment of materials from the Manufacturer's works, Contractor shall furnish six hard copies and an electronic copy of the following:

i) Test certificates for each batch of materials.

ii) Specific installation instruction with pictorial illustrations.

iii) Specific storage and handling instructions.

5.3 All documents shall be in English Language only.

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STANDARD SPECIFICATION

FOR
QUALITY MANAGEMENT SYSTEM

VPC – SS – PP - 2028

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3.0 QUALITY SYSTEM REQUIREMENT..... 3

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1.0 SCOPE

This document covers minimum requirement for Quality Management system (QMS) to be met with by the manufacturers, suppliers or service providers (herein after called Contractors) to ensure that only quality products/services are delivered to the purchaser/Owner (herein after called Company).

2.0 GENERAL REQUIREMENT

2.1 The Contractor shall have established and in operation a QMS which fully complies with requirements of ISO 9001 – 2008 or equivalent standard for Quality Management System. The established and in operation QMS shall be such that all quality related activities related to the execution of contract are well planned and controlled systematically to ensure end goal of delivering product/service of required standard of quality.

2.2 The QMS shall be well documented and understood by all, including Sub Contractors/suppliers, concerned with delivery of product/service to the Company.

2.3 The Contractor shall draw a project specific quality plan based on his organization's Quality Manual and standard Quality Plan and same is to be implemented throughout the period of project execution.

2.4 The quality plan thus prepared shall be such that specified and intended requirements of the contract are fully understood by all and duly met with while delivering produce/service.

3.0 QUALITY SYSTEM REQUIREMENT

3.1 DOCUMENTATION REQUIREMENT

3.1.1 Documents to be submitted at the time of bidding.

Following QMS documents shall be submitted by the Contractor intending to bid for project at the time of submitting their bids:

a) Corporate Quality Policy document duly signed by the Corporate Head or any other Authorized representative.

b) Documents in support of successful implementation of Quality Management System (QMS) within the organization of the contractor such as certificate of quality system registration, previous project Quality Plans, Company`s Quality Manual, and Quality Audit reports etc.

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(c) Project Specific Quality Plan demonstrating the proposed method for achieving the Quality Objectives which shall as a minimum conform to ISO 9001:2008 or equivalent.

(d) CVs of the personnel proposed for job execution. Failure to submit the above Quality documents is liable to cause rejection of the bid.

3.1.2 Documents to be submitted after award of contract.

Within two (2) weeks after award of Contract and, in any case prior to commencement of any project related activity, the contractor shall provide, as a minimum, the following documents :

a) Job specific Quality Plan, Procedures, and Work Instructions, job specific Inspection and Test Plans (ITP) and Reporting Formats (Quality Records)

b) Project Specific Organization chart with responsibilities and authorities clearly defined for each specific role for complete organization and organization proposed for job execution.

c) Procedure to calibrate and maintain required measuring and test equipment.

d) Procedure for tracing the root cause for non-conformance and segregation of Non-confirming product/services.

e) Procedure for Management of change.

f) Plan and procedure for periodical internal Quality Audit for duration of contract.

g) Procedure for control of non-confirming products

h) Procedure for documentation control Project Contracted work can commence only after obtaining written approval of above documentation from Company.

In addition, following documentation shall be maintained by the Contractor for submission to Company on demand at any point of time during the execution of the project.

a) Project Quality Manual

b) Reports of internal and external Quality Audits conducted during execution of contract.

c) Corrective Action Report on the project audits observations/non-conformities reported.

Upon completion of Contract, the Contractor shall compile and submit a dossier containing quality records including exceptions/deviations granted by Company, non-conformance records, audit records or any other quality related records applicable to the works covered under contract.

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3.2 FUNCTIONAL REQUIREMENT FOR QUALITY SYSTEM IMPLEMENTATION

3.2.1 Experienced, knowledgeable and qualified personnel shall be deployed for execution of various activities related to work covered under Contract. Contractor shall arrange for adequate infrastructure and suitable work environment to ensure that the specification and quality of the product/services are maintained. Responsibilities and Authorities shall be communicated to all personnel identified for execution of work covered under Contract.

3.2.2 Contractor to ensure that the Authority responsible for job execution has communicated the Contract requirements, including all identified or intended statutory and regulatory requirement, to all concerned in their organization and subcontractor's organization who are to participate in the work execution.

3.2.3 Contractor shall implement, maintain and operate project specific QMS approved by Company.

3.2.4 The Contractor shall do advance quality planning, for all activities involved in delivery Of product/services, which shall cover as minimum:

A) Resource Planning
B) Identification of Product/Service characteristics required to be controlled to ensure quality
C) Identify process characteristics for realization of intended product/service characteristics
D) Identify measurement and test requirement and define acceptance criteria for same.
E) Generation and management of records
F) Any additional procedures required to be developed specific to the Project.

3.2.5 Based on above the Contractor shall prepare and submit, for Company review and approval, a project specific Quality Plan, Inspection and Test Plan and work execution procedures for contracted work scope. The Quality Plan shall address all of the applicable elements of ISO 9001-2008, identify responsible parties, within Contractor`s organization, for the implementation / control of each area, reference the applicable procedures used to control and verify the documents produced for each area of working. Approved Quality Plan, ITP`s and work procedure shall be available at its working place and well understood by concern personals.

3.2.6 During execution of work, Company reserves the right to undertake QMS Audit as deemed necessary to assess the effectiveness of the implementation of Contractor's quality management system.

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3.2.7 Contractor shall validate all processes for production and/or services for which output cannot be verified by monitoring and measurements during execution. This includes any process where deficiencies become apparent only after the product is in use or service has been delivered.

3.2.8 Contractor shall establish a system for identification and traceability of product/deliverable throughout product realization.

3.2.9 Contractor shall identify, verify, protect and safeguard Company's property (materials/documents) provided for use or incorporation in to the product/service. If any property is lost, damaged, misused or otherwise found to be unsuitable for use, this shall be reported to Company at the earliest.

3.2.10 Contractor shall establish system to ensure that inspection and testing activities are carried out in a manner that is consistent with the requirements. Measuring equipment shall be calibrated at specified frequency against national or international standards. Where no such standard exits, the basis used for calibration shall be recorded. Calibration certificate shall be available for review by Company on demand.

3.2.11 Contractor shall monitor and measure the characteristics of the product/deliverable to verify that contract requirement has been met. The inspection (stage wise as well as final) by Contractor and Company personnel shall be carried out as per approved ITPs.

3.2.12 Non-conformities (NCs) / deficiencies found by Contractor's inspection /surveillance staff or observed by Company representative shall be duly recorded, including their disposal action and resolved. Effective corrective and preventive action plan shall be implemented by Contractor to prevent recurrence.

3.2.13 Deviation from the approved drawings / specification shall be intimated to Company in advance and specific waiver from Company shall be obtained. Any un-approved deviation shall be treated as non-conformity and a Non Conformance Reports (NCR) shall be raised and processed as per approved procedure.

3.2.14 All project records shall be carefully kept, maintained and protected for any damage or loss until the project completion, and handed over to Company as per contract requirement or disposed as per relevant project procedure.

3.2.15 The Contractor shall note that product/service will be considered to have been delivered after complete records have been submitted to the Company and the Company has accepted the same.

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3.3 QUALITY CHECKS AND AUDITS

During approval of QMS document, Company will identify the stage and extent of its involvement during inspection and testing of product. Company may put on 'HOLD' activities that must be reviewed by Company before work proceeds further that could obstruct necessary verification of the submitted activity. For such inspections Company may require work to be held until Company informs whether or not its representative will attend to witness the inspection/testing.

Contractor shall plan and carryout the QMS audit for the job. Quality Audit program shall cover design, procurement, construction management and commissioning, as applicable, including activities carried out by sub-vendors and sub-contractors. This shall be additional to the surveillance audits carried out certification/recertification of QMS of Contractor`s Organization.

The audit program and audit reports shall be submitted to Company for information. Company reserves the right to attend, as a witness, any audit conducted during the execution of the works.

In addition to above, Company and/or independent Third Party Inspection Agency (TPI) engaged for the project may also perform Quality and Technical Compliance Audits. Contractor shall provide assistance and access to its systems and sub-contractor/vendor`s systems, as may be required for the purpose.

Company will not act as an inspector for the work being carried out. This responsibility lies entirely on the Contractor, who must fulfil it at all times, for all work, in accordance with the Company approved QMS. Company's actions will be to audit the compliance of the QMS by the Contractor, by varying degrees of review or involvement on the activities performed by the Contractor.

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ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION
FOR
SURVEY FOR
UNDERGROUND SERVICES USING GPR

VPC-SS-PP-2037

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
01	03.01.2022	SR	MC	HK	HK

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Abbreviations:

2-D	:	Two Dimensional
3-D	:	Three Dimensional
BM	:	Bench Mark
C/C	:	Center to Center
GPR	:	Ground Penetration Radar
GPS	:	Global Positioning System
LSTK	:	Lump Sum Turn Key
U/G	:	Underground

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1.0 SCOPE

The intent of this specification is to cover the basic requirements for conducting the survey works for locating and tracing underground services at the location/ area identified in tender document or identified by the CLIENT to generate requisite information for the design and field engineering activities.

1.1 This specification covers the following works.

a) Establishment of base line for defining the co-ordinates of the various areas.

b) Mapping of location, elevation, properties, and size of underground pipeline, cables and other utilities (metallic and non-metallic) including, locating the change in direction of the facility using Ground Penetration Radar (GPR).

c) Preparation of surveys maps.

d) Two dimensional (2-D)/ three dimensional (3-D) AutoCAD file for the underground services as per project requirement/ schedule of rates.

1.2 The survey maps shall show all U/G pipes, cables, other utilities (metallic and non-metallic) etc.

1.3 The contractors shall identify Benchmark of the area and shall carry over level from Bench Mark to the site benchmark. This reference of BM shall be recorded on survey drawings.

2.0 DEFINITIONS

TRUE COORDINATE POSITION - The position of a point as determined by field survey originating on a known control survey marker and performed to the precision and adjusted as required for second order surveys (i.e. the horizontal error of closure shall not exceed 1 in 20,000 and the angular error of closure shall not exceed ten seconds times the square root of the number of instrument stations in the traverse, all before adjustment).

GPS (Global Positioning System) - Describes the survey procedure conforming to the U.S. Federal Geographic Data Committee standards as outlined in their publication FGDC-STD- 007.4-2002 for using GPS relative positioning techniques.

3.0 DELIVERABLES BY SURVEYORS

SURVEYOR shall produce the following:

3.1 Drawings

The final drawing shall be prepared and submitted in latest version of AUTOCAD in 2 sets of USB Drive. In addition to the above, 3 sets of colored print of A3 Sheets of the drawing shall also be submitted.

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3.2 Electronic Media

Electronic media on which topographic features and three dimensional surface data is delivered shall be provided in *.dwg & *.dgn format and the files shall be furnished on a USB Drive.

3.3 Property of Maps

Maps prepared by the contractor based on survey work carried out under this agreement shall be the sole property of Client. The contractor shall have no right to use, reproduce or pass on to the third party without prior written permission of Client.

3.4 Maps & Drawings

The survey maps shall be based on the survey work executed and shall show all relevant information pertaining to underground services; permanent bench mark etc.

3.5 Check Prints

Three copies of check prints of the plotted maps shall be supplied by the contractor to Client/Engineer-in-Charge for their approval along with original before submission of final deliverables.

4.0 PERFORMANCE REQUIREMENTS

4.1 The work shall be carried out by using Ground Penetration Radar (GPR) by qualified and competent surveyors under the direct supervision of qualified geophysicist.

4.2 The survey shall be carried out with reference to the existing permanent benchmarks.

4.3 The contractor shall be able to locate and map electrical and signal cables up to a depth of 2 Meters and Pipes (metallic and non-metallic) of sizes up to a depth of 6 Meters from ground level.

4.4 All measurements shall be in metric units.

4.5 The corrections arising from the standard errors shall be incorporated suitably.

4.6 The observations for the measurement of vertical distances on benchmarks and turning points shall be read nearest to 5 mm and for other nearest to 10mm.

5.0 METHODOLOGY OF SURVEY WORKS

5.1 Location Survey of Existing Control Points

a) A preliminary survey to identify existing control points shall be carried out and their correctness ensured.

b) All such control points shall be demarcated in the area plan.

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c) The nearest available permanent benchmark shall be transferred to the area either on a permanent feature or on a concrete pillar specially erected for the purpose.

5.2 Map Contents

5.2.1 Limits of Mapping

The mapped area shall include the entire area of the property identified in the contract documents.

5.2.2 Details

a) General

- Show accurately all underground features within the limits of mapping including, but not limited to, the following:

- Underground pipe lines (Carbon steel, RCC, Plastic and other non-metallic):
  Obtain location, elevation, properties, and size of underground pipelines and utilities at 10-meter intervals and at the change in direction of the pipelines.

- Underground electrical and instrumentation Cables.

- Other Underground utilities and structures.

b) Coordinate Grid System

Compile the map based on the plant grid system. Indicate on the drawing the permanent reference points to which the fieldwork is tied for horizontal control.

c) Drawing Scale

Survey contractor shall prepare drawings at a scale of 1:500.

5.3 Field Survey Requirements

5.3.1 General

The SURVEYOR shall perform survey work required to establish horizontal and vertical control sufficient to achieve the specified map accuracy. Perform sufficient supplementary field survey work to ascertain the true horizontal and vertical location of existing underground features.

Specification /Details along-with resolution of the GPR or equipment, to be used by contractor, shall be provided to Client for approval/information to ensure the competency of the GPR or equipment for application.

5.3.2 Accuracy

Perform field survey work with sufficient precision to ensure that the required accuracy of the finished drawing is achieved. The computed coordinate position of each horizontal

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control point used in compiling the drawing shall be correct within the limits of second order accuracy.

The accuracy level of pipe sizes shall be in the order of ±10%.

The accuracy level of depth of services shall be in the order of ±100mm.

5.4 Computer Graphics Data

5.4.1 General Data Requirements

a. An electronic design file shall be provided for each of the final maps. A composite of the total mapped area shall be produced in electronic *.dgn & *.dwg design file in addition to the individual maps. Additional survey data required by the contract document shall be incorporated into final electronic *.dgn & *.dwg design file and provided in *.ASC file format as follows:

   Point Number, Northing, Easting, Elevation, Description P, _N,_E,_Z,_DESC).

5.4.2 3-D Data

All 3-D elements shall be at the actual Z value.

5.4.3 3-D Model

Contractor shall provide 3-D model of the underground utilities after survey.

5.4.4 5.4.4 Scale

Record scale-dependent data (such as text, cells, symbols) at a scale factor suitable for display at the specified map scale.

5.4.5 5.4.5 Text

Text shall be a minimum of 2.5 mm in height when plotted.

5.4.6 Working Units

Set up data files on the basis of the following working units:

(MU) Master Units = 1 meter

(SU) Subunits = 1000 mm

5.4.7 Global Origin

Global origin of all design files shall be at the center of the MicroStation/ AutoCad design cube.

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5.4.8 **Symbols and Patterns**

Symbols and patterns incorporated into the map shall be of appropriate cells available to the SURVEYOR either of his own creation or as supplied by other software packages. All symbols and patterns used shall be clearly identified as such in the map legend on each drawing delivered.

6.0 PAYMENT

6.1 Payment for survey work shall be made on area basis as per schedule of items. No other payment shall be made. All connected works including supply of drawings and electronic files shall be considered as part of the total work.

6.2 The payment clause(s) as described in this standard specification shall not be referred /applicable for LSTK Jobs.

7.0 SPECIFIC REQUIREMENTS

If, survey is carried out inside hydrocarbon plants / areas, all survey equipment to be used shall be intrinsically safe suitable for use in hazardous area.

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VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION
FOR
DOCUMENTATION REQUIREMENTS
FROM SUPPLIERS

VPC – SS – PP - 2043

00	**20.07.2020**	**MB**	**MC**	**AD**	**SK**
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Abbreviations:

DCI	:	Document Control Index
edms	:	Electronic Document Management System
FOA	:	Fax of Acceptance
HOD	:	Head of Division / Department
IC	:	Inspection Certificate
IRN	:	Inspection Release Note
ITP	:	Inspection and Test Plan
LOA	:	Letter of Acceptance
MOU	:	Memorandum of Understanding
MR	:	Material Requisition
PO	:	Purchase Order
PR	:	Purchase Requisition
PVC	:	Polyvinyl Chloride
QMS	:	Quality Management System
TPIA	:	Third Party Inspection Agency
URL	:	Universal Resource Locator

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Attachments

Format for completeness of Final Documentation Annexure-1

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1.0 SCOPE

This specification establishes the Documentation Requirements from Suppliers. All documents/data against the PO / PR / MR shall be developed and submitted to OWNER by the suppliers for review / records, in line with this specification.

2.0 DEFINITIONS

2.1 Supplier

For the purpose of this specification, the word "SUPPLIER" means the person(s), firm, company or organization who is under the process of being contracted by OWNER for delivery of some products (including service). The word is considered synonymous to bidder, contractor or vendor.

2.2 Owner

Owner means the owner of the project for which services / products are being purchased and includes their representatives, successors and assignees.

3.0 REFERENCE DOCUMENTS

VPC-SS-PP-2044 Standard Specification for Quality Management System Requirements from Vendors

4.0 DOCUMENTATION REQUIREMENTS

4.1 Documents/Data to be Submitted by the Supplier

4.1.1 The Supplier shall submit the documents and data against the PO/PR/MR as per the list given in respective PO/PR/MR.

4.1.2 Review of the supplier drawings by PMC/ OWNER would be only to review the compatibility with basic designs and concepts and in no way absolve the supplier of his responsibility/contractual obligation to comply with PR requirements, applicable codes, specifications and statutory rules/regulations. Any error/deficiency noticed during any stage of manufacturing/execution/installation shall be promptly corrected by the supplier without any time and cost implications, irrespective of comments on the same were received from OWNER during the drawing review stage or not.

4.1.3 Unless otherwise specified, submission of documents for Review/Records shall commence as follows from the date of Fax of Intent / Letter of Intent/ Fax of Acceptance (FOA)/ Letter of Acceptance (LOA):

QMS - 1 week

Drawing/Document Control Index - 2 weeks

Other Documents/Drawings - As per approved Drawing/Document Control Index/Schedule

4.1.4 Documents as specified in PO/PR/MR are minimum requirements. Supplier shall submit any other document/data required for completion of the job as per OWNERs instructions.

4.2 Style and Formatting

4.2.1 All Documents shall be in ENGLISH language and in M.K.S System of units.

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4.2.2 Before forwarding the drawings and documents, contractor shall ensure that the following information are properly mentioned in each drawing:

Purchase Requisition Number

Name of Equipment / Package

Equipment / Package Tag No.

Name of Project

Client

Drawing / Document Title

Drawing / Document No.

Drawing / Document Revision No. and Date

4.3 Review and Approval of Documents by Supplier

4.3.1 The Drawing/Documents shall be reviewed, checked, approved and duly signed/stamped by supplier before submission. Revision number shall be changed during submission of the revised supplier documents and all revisions shall be highlighted by clouds. Whenever the supplier requires any sub-supplier drawings to be reviewed by OWNER, the same shall be submitted by the supplier after duly reviewed, approved and stamped by the supplier. Direct submission of sub-supplier's drawings without contractor's approval shall not be entertained.

4.4 Document Category

4.4.1 Review Category

Following review codes shall be used for review of supplier Drawings/Documents:

Review Code A	-	No comments. Proceed with manufacture/ fabrication as per the document.
Review Code B	-	Proceed with manufacture/fabrication as per commented document. Revised document required.
Review Code C	-	Document does not conform to basic requirements as marked. Resubmit for review
Review Code D	-	Document Rejected
Review Code F	-	For information
R	-	Document is retained for Records. Proceed with manufacture/fabrication.
V	-	Void

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4.5 Methodology for Submission of Documents to PMC/Owner

4.5.1 Document Control Index (DCI)

Supplier shall create and submit Document Control Index (DCI) for review based on PO/PR/MR along with schedule date of submission of each drawing/document on OWNERs eDMS. The DCI shall be specific with regard to drawing/document no. and the exact title. Proper sequencing of the drawings/documents should be ensured in scheduled date of submission on of the job as per OWNER.

4.5.2 Submission of Drawings/Documents

Drawings/documents and data shall be uploaded on the eDMS Portal as per DCI

4.5.3 Statutory Approvals

Wherever approval by any statutory body is required to be taken by Supplier, the Supplier shall submit copy of approval by the authority to PMC/OWNER.

4.5.4 Details of Contact Persons of Supplier

After placement of order supplier shall assign a Project Manager for that order. The details are to be filled online through the portal. The details include e-mail address, mailing address, telephone nos., fax nos. and name of Project Manager. All the system generated emails pertaining to that order shall be sent to the assigned Project Manager.

4.5.5 Schedule and Progress Reporting

Supplier shall submit monthly progress report and updated procurement, engineering and manufacturing status (schedule vs. actual) every month, beginning within 2 weeks from FOA/LOA . In case of exigencies, PMC/Owner can ask for report submission as required on weekly/fortnightly/adhoc basis depending upon supply status and supplier shall furnish such reports promptly without any price implication. Format for progress report shall be submitted by the Supplier during kick off meeting or within one week of receiving FOA/LOA, whichever is earlier.

4.5.6 Quality Assurance Plan/Inspection and Test Plan

Inspection and test plans (ITP) attached if any, to the MR/PR are to be followed.

However for cases wherein ITPs have not been attached with MR/PR, Supplier shall submit within one week of receiving FOA/LOA, the Quality Assurance Plan for manufacturing, covering quality control of critical bought out items/materials, inspection& testing at various stages of production, quality control records and site assembly &testing as may be applicable to the specific order and obtain approval from OWNER /PMC/ third party inspection agency, as applicable.

For Package equipment contracts, the supplier shall prepare a list of items/ equipment's and their inspection categorization plan for all items included in the scope of supply immediately after receipt of order and obtains approval for the same from OWNER. The

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items shall be categorized into different categories depending upon their criticality for the scope of inspection of TPIA and/or OWNER/ OWNER appointed PMC.

4.5.7 Inspection Release Note (IRN)/ Inspection Certificate (IC)

IRN/ IC shall be issued by PMC Inspector/ third party inspection agency on the basis of successful inspection, review of certificates as per specifications & agreed quality plan (as applicable) and only after all the drawings/documents as per DCI are submitted and are accepted under review code-A or code R. Supplier shall ensure that necessary documents/manufacturing and test certificates are made available to PMC/TPIA as and when desired.

Note: Non fulfilling above requirement shall result into appropriate penalty or withholding of payment as per conditions of PO/PR/MR.

Transportation Plan for Over Dimensional Consignments (ODC), if any, shall be submitted within 2 weeks of receiving FOA/LOA, for approval. Consignment with parameters greater than following shall be considered as over dimensional.

Dimensions: 4 meters width x 4 meters height x 20 meters length

Weight: 32 MT

4.6 Final Documentation

4.6.1 As Built Drawings

Shop changes made by Supplier after approval of drawings under `Code A' by OWNER/OWNER appointed PMC and deviations granted through online system , if any, shall be marked in hard copies of drawings which shall then be stamped 'As-built' by the supplier. These 'As-built' drawings shall be reviewed and stamped by PMC Inspector/TPIA also. Supplier shall prepare scanned images files of all marked — up 'As — built drawings. Simultaneously Supplier shall incorporate the shop changes in the native soft files of the drawings also.

4.6.2 As Built Final Documents

As built final documents shall be submitted as listed in PO/PR/MR.

4.6.3 Packing/Presentation of Final Documents

Final Documents shall be legible photocopies in A4, A3 size only. Drawings will be inserted in plastic pockets (both sides transparent, sheet thickness minimum 0.1 mm) with an extra strip of 12 mm wide for punching so that drawings are well placed.

Final Documentation shall be bound in Hard board Plastic folder(s) of size 265 mm x 315 mm (101 /2 inch x 12 1 /2 inch) and shall not be more that 75 mm thick. It may be of several volumes and each volume shall have a volume number, index of volumes and index of contents of that particular volume. Where number of volumes are more, 90mm thickness can be used. Each volume shall have top PVC sheet of minimum 0.15mm thick duly fixed and pressed on folder cover and will have 2 lever clips. In case of imported items documents, 4 lever clips shall also be accepted. All four corners of folders shall be properly metal clamped. Indexing of contents with page numbering must be incorporated by supplier. Spiral/Spico bound documents shall not be acceptable. As mentioned above,

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books should be in hard board plastic folders with sheets punched and having 2/4 lever clips arrangement.

Each volume shall contain on cover a Title Block indicating package Equipment Tag No. & Name, PO/Purchase Requisition No., Name of Project and Name of Customer. Each volume will have hard front cover and a reinforced spine to fit thickness of book. These spines will also have the title printed on them. Title shall include also volume number (say 11 of 15) etc.

4.6.4 Submission of Soft Copies

Supplier shall submit to OWNER, the scanned images files as well as the native files of

Drawings / documents, along with proper index.

In addition to hard copies, Supplier shall submit electronic file (CD-ROM) covering soft

copies of all the final drawings and documents, all text documents prepared on computer, scanned images of all important documents (not available as soft files), all relevant catalogues, manuals available as soft files (editable copies of drawings/text documents, while for catalogues/manuals/proprietary information and data, PDF files can be furnished).

All the above documents shall also be uploaded on the OWNERs eDMS portal.

4.6.5 Completeness of Final Documentation

Supplier shall get the completeness of final documentation verified by PMC appointed TPIA and attach the Format for Completeness of Final Documentation Format duly signed by OWNER/ OWNER appointed PMC/ Inspector or TPIA as applicable to the document folder.

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ANNEUXRE-1

COMPLETENESS OF FINAL DOCUMENTATION

Name of Supplier/Contractor :

Customer :

Project :

OWNER's Job No. :

Purchase Order No./

Contract No. :

Purchase Requisition No./

Tender No. : Rev. No. :

Name of the Work/

Equipment :

Tag. No. :

Supplier's/ Contractor's

Works Order No. :

Certified that the Engineering Documents/ Manufacturing & Test Certificates submitted by the supplier is complete in accordance with the Vendor Data Requirements of Purchase Requisition.

Signature :..... Signature:.....

Date :..... Date:.....

Name :..... Name:.....

Designation :..... Designation:.....

Department :..... Department:.....

Supplier/Contractor **OWNER/PMC/TPIA**

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VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION
FOR
QUALITY MANAGEMENT SYSTEM
REQUIREMENT FROM VENDORS

VPC – SS – PP - 2044

00	**20.07.2020**	**MB**	**MC**	**AD**	**SK**
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Abbreviations:

CV	:	Curriculum Vitae
ISO	:	International Organization for Standardization
MR	:	Material Requisition
PO	:	Purchase Order
PR	:	Purchase Requisition
QA	:	Quality Assurance
QMS	:	Quality Management System

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1.0 SCOPE

This specification establishes the Quality Management System requirements to be met by BIDDER for following purpose:

- QMS requirements to be met by suppliers/contractors after award of work/ during contract execution.

2.0 DEFINITIONS

2.1 Bidder

For the purpose of this specification, the word "BIDDER" means the person(s), firm, company or organization who is under the process of being contracted by Owner for delivery of some products (including service). The word is considered synonymous to supplier, contractor or vendor.

2.2 Project Quality Plan

Document tailored from Standard Quality Management System Manual of BIDDER, specifying how the quality requirements of the project will be met.

2.3 Owner

Owner means the owner of the project for which services / products are being purchased and includes their representatives, successors and assignees.

3.0 REFERENCE DOCUMENTS

VPC-SS-PP-2043 Standard Specification for Documentation Requirements from Suppliers

4.0 QUALITY MANAGEMENT SYSTEM — GENERAL

Unless otherwise agreed with PMC / Owner, the BIDDER proposed quality system shall fully satisfy all relevant requirements of ISO 9001 "Quality Management Systems - Requirements." Evidence of compliance shall be current certificate of quality system registration to ISO 9001 or a recent compliance audit recommending registration from a certification agency. The quality system shall provide the planned and systematic control of all quality related activities for execution of contract. Implementation of the system shall be in accordance with BIDDER'S Quality Manual and PROJECT specific Quality Plan.

5.0 QUALITY SYSTEM REQUIREMENTS

5.1 BIDDER shall prepare and submit for review / record, Project Quality Plan / Quality Assurance Plan for contracted scope / job. The BIDDER'S Quality Plan shall address all of the applicable elements of ISO 9001, identify responsible parties within BIDDER'S organization, for the implementation / control of each area, reference the applicable procedures used to control / assure each area, and verify the documents produced for

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each area. The Project Quality Plan shall necessarily define control or make reference to the relevant procedures, for design and engineering, purchase, documentation, record control, bid evaluation, inspection, production/manufacturing, preservation, packaging and storage, quality control at construction site, pre-commissioning, commissioning and handing over (as applicable) in line with contract requirement and scope of work.

5.2 BIDDER shall identify all specified or implied statutory and regulatory requirements and communicate the same to all concerned in his organization and his sub contractor's organization for compliance.

5.3 BIDDER shall deploy competent and trained personnel for various activities for fulfilment of PO / contract. BIDDER shall arrange adequate infrastructure and work environment to ensure that the specification and quality of the deliverable are maintained.

5.4 BIDDER shall do the quality planning for all activities involved in delivery of order. The quality planning shall cover as minimum the following:

- Resources
- Product / deliverable characteristics to be controlled.
- Process characteristics to ensure the identified product characteristics are realized
- Identification of any measurement requirements, acceptance criteria
- Records to be generated
- Need for any documented procedure

The quality planning shall result into the quality assurance plan, inspection and test plans (ITPs) and job procedures for the project activities in the scope of bidder.

These documents shall be submitted to PMC/Owner for review/approval, before commencement of work.

5.5 Requirements for sub-contracting / purchasing of services specified in contract / tender shall be adhered to. In general, all outsourced items will be from approved vendors of OWNER. Wherever requirements are not specified, or approved sub vendors do not exist, the sub-contractor shall establish and maintain a system for purchasing / sub-contracting to ensure that purchased product / service conforms to specified requirements. Criteria for selection of sub-contractor, evaluation, re-evaluation, maintenance of purchasing data and verification of purchased product (subcontractor services), constitute important components of this requirement.

5.6 BIDDER shall plan and carry production and service provision under controlled conditions. Controlled conditions shall include, as applicable the availability of information that describes the characteristics of the product the availability of work instructions the use of suitable equipment the availability and use of monitoring and measuring devices the implementation of monitoring and measurement the implementation of release, delivery and post-delivery activities.

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5.7 BIDDER shall validate any processes for production and service provision where resulting output cannot be verified by subsequent monitoring and measurement. This includes any process where deficiencies become apparent only after the product is in use or service has been delivered.

5.8 BIDDER shall establish a system for identification and traceability of product /deliverable throughout product realization. Product status with respect to inspection and testing requirements shall be identified.

5.9 BIDDER shall identify, verify, protect and safeguard PMC / Owner property (material / document) provided for use or incorporation into the product. If any OWNER/ PMC property is lost, damaged or otherwise found to be unsuitable for use, this shall be reported to the OWNER/ PMC.

5.10 BIDDER shall ensure the conformity of product / deliverable during internal processing and delivery to the intended destination. Requirements mentioned in the tender shall be adhered to.

5.11 BIDDER shall establish system to ensure that inspection and testing activities are carried out in line with requirements. Where necessary, measuring equipment's shall be calibrated at specified frequency, against national or international measurement standards; where no such standard exists, the basis used for calibration shall be recorded. The measuring equipment's shall be protected from damage during handling, maintenance and storage.

5.12 BIDDER shall ensure effective monitoring, using suitable methods, of the processes involved in production and other related processes for delivery of the scope of contract.

5.13 BIDDER shall monitor and measure the characteristics of the product/deliverable to verify that product requirement has been met. The inspection (stage as well as final) by BIDDER and OWNER / Owner personnel shall be carried out strictly as per the ITPs forming part of the contract. Product release or service delivery shall not proceed until the planned arrangements have been satisfactorily completed, unless otherwise approved by relevant authority and where applicable by Owner / PMC.

5.14 BIDDER shall establish and maintain a documented procedure to ensure that the product which does not conform to requirements is identified and controlled to prevent its unintended use or delivery.

5.15 All non-conformities (NCs) / deficiencies found by the BIDDER'S inspection /surveillance staff shall be duly recorded, including their disposal action shall be recorded and resolved suitably. Effective corrective and preventive action shall be implemented by the BIDDER so that similar NCs including deficiencies do not recur.

5.16 All deficiencies noticed and reported by PMC / OWNER shall be analysed by the BIDDER and appropriate corrective and preventive actions shall be implemented. BIDDER shall intimate PMC / OWNER of all such corrective and preventive action implemented by him.

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5.17 BIDDER should follow the standards, specifications and approved drawings. Concessions/Deviations shall be allowed only in case of unavoidable circumstances. In such situations Concession/deviation request must be made by the BIDDER through online system of OWNER/ PMCs eDMS.

5.18 BIDDER shall have documented procedure for control of documents.

5.19 All project records shall be carefully kept, maintained and protected for any damage or loss until the project completion, then handed over to PMC / Owner as per contract requirement (VPC-SS-PL-0047 Specification for Documentation Requirements from Suppliers), or disposed as per relevant project procedure.

6.0 AUDITS

BIDDER shall plan and carry out the QMS audit for the job. Quality audit programme shall cover design, procurement, construction management and commissioning as applicable including activities carried out by sub-vendors and sub-contractors. This shall be additional to the certification body surveillance audits carried out under BIDDER'S own ISO 9001 certification scheme.

The audit programmes and audit reports shall be available with bidder for scrutiny by PMC / OWNER. PMC or OWNER representative reserves the right to attend, as a witness, any audit conducted during the execution of the WORKS.

In addition to above OWNER, PMC and third party appointed by PMC/Owner may also perform Quality and Technical compliance audits. BIDDER shall provide assistance and access to their systems and sub-contractor / vendor systems as required for this purpose. Any deficiencies noted shall be immediately rectified by BIDDER.

7.0 DOCUMENTATION REQUIREMENTS

BIDDER shall submit following QMS documents immediately after award of work (Within one week) for record / review by PMC/ Owner.

- Organization chart (for complete organization structure and for the project)
- Project Quality Plan/Quality Assurance Plan
- Job specific Inspection Test Plans, if not attached with PR
- Job Procedures
- Inspection/Test Formats

In addition to above QMS documents, following documentation shall be maintained by the BIDDER for submission to PMC / Owner on demand at any point of time during execution of the project.

- Quality Manual
- Certificate of approval for compliance to ISO: 9001 standards
- Procedure for Control of Non-conforming Product

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- Procedure for Control of Documents
- Sample audit report of the QMS internal and external audits conducted during last one year
- Customer satisfaction reports from at least 2 customers, during the last one year
- Project QMS audit report
- Technical audit reports for the project
- Corrective action report on the audits

Documents as specified above are minimum requirements. BIDDER shall submit any other document/data required for completion of the job as per PMC/Owner instructions.

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ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION
FOR
SEAMLESS FITTINGS AND FLANGES
{SIZE UPTO DN 400MM (16”)}

VPC – SS – PP - 2024

00	28.01.2020	MB	MC	AD	SK
Rev. No	**Date**	**Prepared By**	**Checked By**	**Approved By**	**Authorized By**

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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell hardness number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council
CE	Carbon Equivalent
LTCS	Low Temperature Carbon Steel
LPG	Liquefied Petroleum Gas

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1.0 SCOPE

This Technical specification specifies the minimum requirements for the design, manufacture and supply of following carbon steel flanges (such as welding neck flanges, blind flanges, spectacle blinds, spacers and blind etc.) and seamless fittings (such as tees, elbows, reducers, caps, outlets etc.) size DN up to 400 mm (16") to be installed in onshore pipeline systems handling non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry unless specified otherwise) of the following Codes, Standards and Specification.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4	:	Pipeline Transportation system for liquid Hydrocarbon & other liquids.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.5	:	Pipe Flanges and Flanged Fitting.
B16.9	:	Factory made Wrought Butt Weld Fittings.
B 16.11	:	Forged Steel Fittings, Socket welding and Threaded.
B 16.48	:	Steel Line Blanks.
Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels.
Section IX	:	Welding and Brazing Qualifications.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-25	:	Standard Marking System for Valves, Fittings, Flanges and Unions.
SP-97	:	Forged Carbon Steel Branch Outlet Fittings- Socket Welding, Threaded and Butt Welding Ends

In case of conflict between various requirements of this specification and the requirements of above referred Codes and Standards, more stringent requirement shall apply unless otherwise agreed by Purchaser.

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3.0 MATERIALS

The Material of flanges & fittings shall be as indicated in purchase requisition. In addition, the material shall also meet the requirements specified hereinafter.

3.1 The Carbon Steel used for the manufacture of flanges and fittings shall be fully killed.

3.2 The carbon equivalent (CE) shall not exceeding 0.45, based on check analysis calculated in accordance with following.

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

3.3 For flanges and fittings specified to be used for gas service or LPG service, Charpy V-notch test shall be conducted on each heat of steel. Unless specified otherwise, the Charpy V-notch test shall be conducted at 0^0 C in accordance with the impact test provisions of ASTM A 370 for flanges and MSS-SP-75 for all fittings.

The average absorbed impact energy values of three full-sized specimens shall be 27 joules. The minimum impact energy value of any one specimen of the three specimens analysed as above shall not be less than 22 Joules.

When Low Temperature Carbon Steel (LTCS) materials are specified for flanges and fittings in Purchase Requisition, the Charpy V-notch test requirements of applicable material standard shall be complied with.

3.4 For flanges and fittings specified to be used for Gas service or LPG service, Hardness test shall be carried out as per ASTM A 370 for each heat of steel used. A full thickness cross section shall be taken for this purpose and the maximum hardness of base metal, Weld metal and heat affected zone shall not exceed 248 HV_{10}.

3.5 In case of RTJ (Ring Type Joint) flanges, the groove hardness shall be minimum 140 BHN. Ring Joint flanges shall have octagonal section of Ring joint.

4.0 DESIGN AND MANUFACTURE

4.1 Flanges such as weld neck flanges and blind flanges shall conform to the requirements of ASME B 16.5.

4.2 Spectacle blind and spacer & blind shall conform to the requirements of ASME B 16.48.

4.3 Fittings such as tees, elbows, reducers, etc. shall be seamless type and shall conform to ASME B 16.9 for sizes DN 50mm (2") to DN 400mm (16") (both sizes included) and ASME B 16.11 for sizes DN 15mm(1½") &below.

4.4 Fittings such as weldolets, sockolets, nippolets, etc. shall be manufactured in accordance with MSS-SP-97.

4.5 Repair by Welding on flanges and fitting is not permitted.

4.6 All butt weld ends shall be beveled as per ASME B 16.5/ASME B 16.9/MSS-SP-97 as applicable

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4.7 Type, face and finish of flanges shall be as specified in purchase requisition. The interpretation of range of face finish shall be as follows:

Serrated Finish/125 AARH	:	Serration with 125 to 250μ in AARH.
63 AARH	:	32 to 63μ in AARH.

4.8 Flanges and fittings manufactured from bar stock are not acceptable.

5.0 INSPECTION AND TESTS

The Manufacture shall perform all inspections and tests in accordance with the requirements of this specification and the relevant codes, at his works, prior to shipment. Such inspection and testing shall include, but not be limited to, the following:

5.1 TESTING OF MATERIALS

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard as referred to in this specification.

5.2 VISUAL INSPECTION AND DIMENSIONAL CHECK

All flanges and fittings shall be visually inspected. The internal and external surface of the flanges and fittings shall be free from any strikes, gauges and other detrimental defects.

Dimensional checks shall be carried out on finished products as per ASME B 16.5 for flanges, ASME B 16.48 for spacers and blinds and ASME B 16.9/MSS-SP-97 as applicable for fittings and as per this specification.

5.3 NON-DESTRUCTIVE EXAMINATION

All finished wrought weld ends subject to welding in field, shall be 100% tested for lamination type defects by ultrasonic test. Any lamination larger than 6.35 mm shall not be acceptable.

5.4 The Purchaser reserves the right to perform stage wise inspection and witness tests as indicated above, at the Manufacturer's works, prior to shipment. The Manufacturer shall give reasonable notice of date and time for such inspection and shall provide reasonable access and facilities required for inspection, to the Purchaser's Inspector.

The Purchaser reserves the right to require additional testing, at any time, to confirm Or further investigate a suspected fault. All costs incurred shall be for the Manufacturer's account. In no case shall any action of the Purchaser, or his Inspector, relieve the Manufacturer of his responsibility for material, design, quality, or Performance of the materials concerned. Inspection and tests performed/witnessed by the Purchaser's Inspector shall in no way relieve the Manufacturer of his obligation to perform the required inspection and tests.

6.0 PAINTING

Once all inspection and test have been carried out all external surface shall be thoroughly cleaned to remove grease, dust & rust. Standard mill coating shall be applied on external surface to protect against corrosion during transmit and storage. The coating shall be removable type in field.

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7.0 MARKING

All Flanges & fittings shall be stamped with the requirements of applicable dimensional manufacturing standard. The marking shall also include following:

- PO Number.
- Item Code.

8.0 TEST CERTIFICATES

Manufacture who intends bidding for fittings must possess the records of a successful proof test, in accordance with the provision of ASME 16.9/MSS-SP-75,as applicable.

Manufacturer shall furnish the following certificates:

- Test certificates relevant to the chemical analysis and mechanical properties, including hardness of the materials used for manufacture of flanges and fittings in accordance with the requirement of relevant standards and this specification.
- Test reports on radiography, ultrasonic and magnetic particle examination.
- Certificates for each fitting stating that it is capable of withstanding without leakage a test pressure, which results in a hoop stress equivalent to 100% of the specified minimum yield strength for the pipe with which the fitting is to be attached without impairment of serviceability.

9.0 PACKING & SHIPPING

Ends of all fittings and weld neck flanges shall be suitable protected to avoid any damage during transit. Metallic or high impact plastic bevel protected shall be provided for flanges and fittings. Flanges face shall be suitably protected to avoid any damage during transit.

10.0 DOCUMENTATION

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.

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ENERGISING QUALITY

VCS Quality Services Pvt. Ltd.

STANDARD SPECIFICATION
FOR
QUICK OPENING END CLOSURE
(BLOW DOWN LINES)

VPC – SS – PP - 2025

01	27.01.2022	SR	MC	HK	GW
Rev. No	**Date**	**Prepared By**	**Checked By**	**Approved By**	**Authorized By**

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1.0 SCOPE

This specification covers the minimum requirements for design, manufacture, testing and supply of quick opening end closures to be installed at blow-down points/lines handling non-sour hydrocarbons in gaseous phase.

2.0 REFERENCE DOCUMENTS

Reference has been made in this specification to the latest edition (edition enforce at the time of issue of enquiry) of the following Codes, Standards and Specifications.

ASME B 31.8	-	Gas Transmission and distribution Piping Systems.
ASME B 16.25	-	Butt-Welding Ends
ASME Sec VIII	-	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels
ASME Sec IX	-	Boiler and Pressure Vessel Code - Welding and Brazing Qualifications
API 6 H	-	Specification on End Closures, Connectors and Swivels.
API 1104	-	Standard for Welding Pipeline and Related Facilities.
SSPC-VIS-1	-	Steel Structures Painting Council.

In case of conflict between the requirements of this specification and the requirements of above referred documents, the requirements of this specification shall govern.

3.0 MATERIALS

3.1 Carbon steel material used in the manufacture of pressure containing parts of quick opening end-closure shall be fully killed. In addition, the material shall also meet the requirements specified herein.

The minimum SMYS of the material of pressure containing part of the closure shall be 35,000 psi. Other components shall be as per Manufacturer's Standard. However, all the materials used shall be suitable for the service conditions indicated in the Data Sheets, which will be subject to approval by Company.

3.2 Material of the ends to be field welded by Company shall have Carbon Equivalent not more than 0.45 based on Check analysis for each heat of steel used, calculated as per the following formula:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Ni + Cu}{15}$$

3.3 For quick opening end closures specified to be used for Gas service and LPG service, Charpy V-notch test shall be conducted at 0^0C on each heat of carbon steel material used in manufacture of quick opening end closures. Test procedure shall conform to ASTM A 370. The average absorbed impact energy values of three full-sized specimens shall be 27 Joules. The minimum impact energy value of any one specimen of the three specimens analyzed as above, shall not be less than 22 Joules.

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When Low Temperature Carbon Steel (LTCS) materials are specified in Data Sheet or offered by Manufacturer, the Charpy V-notch test requirements of applicable material standard shall be complied with.

3.4 For quick opening end closures specified to be used for Gas service and LPG service, Hardness test shall be carried out as per ASTM A 370 for each heat of steel used in the manufacture of pressure containing parts of traps. A full thickness cross section shall be taken for this purpose and the maximum hardness of base metal, weld metal and HAZ of all the pressure containing parts shall not exceed 248 HV_{10}.

4.0 DESIGN AND CONSTRUCTION

4.1 End closures shall be designed in accordance with the provisions of ASME B 31.8 and ASME Sec. VIII Division 1. Design factor and corrosion allowance shall be as indicated in the Data Sheet.

4.2 Diameter, thickness, material, ANSI Rating of the pipeline with which the end closure to be welded, shall be as indicated in the Data Sheet. End closure supplied shall be suitable for the same.

4.3 The quick opening end closure shall be of clamp ring/band-lock type or equivalent design and shall consists of a safety pressure release system allowing the opening only when there is no pressure in the trap. End closure shall be hand operated by a single lever operation and operable by one operator. Screwed type or plug-in type of end closures are not permitted.

4.4 End closure shall be suitable for installation in vertical position at an elevation of 3.0 meters above ground level.

4.5 The handling device shall be attached to the welding end hub, which shall be suitable for such attachment.

4.6 End closure shall be provided with a butt-welding end for direct welding with the pipeline. The weld end shall be prepared in accordance with ASME B 31.8.

4.7 All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Sec. IX. The procedure qualification shall also include impact test and hardness test as per Clause 3.3 and 3.4 of this specification and shall meet the requirements as specified therein.

4.8 Completed assembly shall be stress relieved as per the provisions of the design codes.

4.9 The tolerance on internal diameter and out of roundness shall be as per connected pipe specification indicated in the data sheet.

5.0 INSPECTION AND TESTS

5.1 Manufacturer shall perform all inspection and tests as per the requirements of this specification and the relevant codes, standards and specifications, prior to shipment at his Works. Such inspection shall be, but not limited to, the following:

5.1.1 All closures shall be visually inspected. The internal and external surfaces shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.

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5.1.2 Chemical composition and mechanical properties shall be checked as per relevant material standards and this specification, for each heat of steel used.

5.1.3 Dimensional check shall be carried out as per the approved drawings.

5.1.4 Hydrostatic test shall be conducted for all end closures complete in all respects, at a pressure equal to at a pressure equal to 1.25/1.5 times the design pressure as indicated in data sheet. Test duration shall be 15 minutes.

5.1.5 All butt welds shall be 100% radiographically inspected. Procedure and acceptance criteria shall be as per API 1104.

5.1.6 Welds, which cannot be radiographically inspected, shall be inspected by ultrasonic or magnetic particle methods. Procedure and acceptance criteria shall be as per ASME Sec. VIII, Appendix 12 and Appendix 6respectively.

5.1.7 All finished wrought weld ends shall be ultrasonically inspected for lamination type defects for a distance of 50 mm from the end. Any lamination larger than 6.35 mm shall not be acceptable.

5.1.8 A minimum of two closing and opening cycles shall be performed and correct operation of both quick opening and safety system shall be established.

5.2 Company's Inspector reserves the right to perform inspection and witness tests including hydrostatic test, as indicated in clause 5.1 at Manufacturer's works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection, to the Company's Inspector. Only those closures, which have been inspected and certified by Company's Inspector, shall be shipped

Inspection and tests performed/witnessed by Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

6.0 TEST CERTIFICATES

Manufacturer shall furnish the following certificates:

a. Test Certificates relevant to chemical and mechanical properties of the material used as per the relevant standards.

b. Hydrostatic test certificates.

c. Report on Non-Destructive examination.

d. Certificate of satisfactory performance of end closure as per Clause 5.1.8.

7.0 PAINTING, MARKING AND SHIPMENT

7.1 After all inspection and tests required have been carried out, the exterior surface of Quick Opening End Closures shall be thoroughly cleaned, freed from rust and grease and applied with sufficient coats of corrosion resistant paint. Manufacturer shall indicate the type and corrosion resistant paint used in the drawings submitted for approval.

7.2 Marking shall be done on a stainless steel plate and affixed to the body permanently. Marking shall include the following:

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a. Manufacturer's Name

b. Suitable for Dia x Thick Pipeline.

c. ANSI Rating

d. Tag Number

7.3 Before shipment, closures shall be properly packed against damage during transportation. Suitable protection shall be provided for the weld ends.

8.0 SPARES

8.1 Manufacturer shall furnish list of recommended spares and accessories for Quick Opening End Closures required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.

8.2 Manufacturer shall furnish list of recommended spares and accessories required for two years of normal operation and maintenance of Quick Opening End Closures and price for such spares shall be quoted separately.

9.0 DOCUMENTATION

Documentation to be submitted by Manufacturer to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document.

9.1 At the time of bidding, Manufacturer shall submit the following documents:

a) General arrangement drawing of end closure with overall dimensions and cross-sectional drawings.

b) Clause wise list of deviations from this specification, if any.

c) Reference list of similar previous supplies. Reference list of similar supplies of Quick Opening End Closures shall be furnished including Project, Year of supply, Client, Size, Rating and Service for the last five years.

d) Quality Control Manual and Quality Control Plan.

e) List of recommended spares and accessories required during start-up and commissioning.

f) List of recommended spares and accessories required for 2 years of normal operation and maintenance.

9.2 Within three weeks of placement of order, the Manufacturer shall submit the following drawings, documents and specifications for approval:

a. Design calculations according to relevant codes for the end closure.

b. Closure assembly and sectional drawings showing all parts with materials and dimensions.

c. Welding procedure and method of manufacture.

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Once the above-mentioned documents have been approved by the Company, any change in design, material and method of manufacture shall be notified to the Company, whose approval in writing of all changes shall be obtained before the closures are manufactured.

9.3 Within four weeks from the approval date, Manufacturer shall submit the approved drawings, documents and specifications listed in Clause 9.2 of above.

9.4 Prior to shipment, the Manufacturer shall submit the following:

a. Test certificates as listed in Clause 6.0 of this specification.

b. Manual for installation, erection instructions, maintenance and operation instructions.

9.5 All documents shall be in English Language only.

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ENERGISING QUALITY

VCS QUALITY SERVICES PVT.LTD.

STANDARD SPECIFICATION FOR INSULATING JOINT

VPC-SS-PP-2029

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell Hardness Number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council

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1.0 SCOPE

This Specification covers the minimum requirement for the design, manufacture, testing and supply of carbon steel insulating joints to be installed in onshore pipeline systems handling non sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 REFERENCE DOCUMENTS

The design, materials, fabrication, inspection, testing and supply of insulating joints shall comply with the latest edition of the following codes and standards.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4	:	Pipeline Transportation System for Liquid and slurries.
B 31.8	:	Gas Transmission and Distribution Piping Systems.
B16.9	:	Factory made Wrought Butt Weld Fittings.
B 16.25	:	Butt Welding Ends.
BPVC Section VIII	:	Boiler and Pressure Vessel Code - Rules for Construction of Pressure Vessels, Division 1.
BPVC Section IX	:	Welding and Brazing Qualifications.
BPVC Section V	:	Non-Destructive Examination.

AMERICAN PETROLEUM INSTITUTE (API)

Specification 5L	:	Specification for Line Pipe.
1104	:	Specification for Welding Pipelines and Related Facilities.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
D2000	:	Classification System of Rubber Products.
D709	:	Laminated Thermosetting Material.

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-25	:	Standard Marking System for Valves, Fittings, Flanges and Unions.
SP-75	:	Specification for High Test Wrought Butt Welding Fittings.
SP-53	:	Quality Standard for Steel Castings and Forgings for Valves, Flanges and Fittings and Other Piping Components - Magnetic Particle Examination Method.

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National Association of Corrosion Engineers (NACE)

RP 0286	:	Standard Recommended Practice, Electrical Isolation of Cathodically Protected Pipelines.

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

VIS-I	:	Visual Standard.
SP-10	:	Surface Preparation.

PNGRB REGULATIONS :

G.S.R 808(E) T4S : Regulations for Natural Gas Pipelines

G.S.R. Infra/ T4S/ P&PPPL : Regulations for Petroleum and Petroleum products pipelines

G.S.R. 612(E) T4S : Regulations for CGD Network

MISCELLANEOUS

NEC	:	National Electric Code.
ISO 2409	:	Paints and Varnishes - Cross-Cut test.

In case of conflict between various requirements of this specification and reference standards, codes and regulationsmentioned above, more stringent requirement shall apply unless otherwise agreed by Purchaser.

3.0 MATERIALS

3.1 METALLIC COMPONENTS

3.1.1 Material for the pressure containing parts of the insulating joints shall be as indicated in the Insulating joint Data Sheet. Other parts shall be as per the Manufacturer's standard (Suitable for the service conditions indicated in the Insulating Joint Data Sheets/Material requisition), which shall be subject to approval by Company. In addition, the material shall also meet the requirements specified hereinafter.

3.1.2 All process-wetted parts, metallic and non-metallic shall be suitable for the commissioning fluid and service specified by the Company. Manufacturer shall confirm that all wetted parts are suitable for treated water/seawater environment, which may be used during field testing.

3.1.3 All carbon steel used for fabrication of various components of insulating joints shall be fully killed.

3.1.4 For Insulating joints specified to be used for Gas Service or LPG Service, hardness test shall be carried out as per ASTM A370 for each heat of steel used for all pressure containing parts. A full thickness cross section shall be taken for this purpose and the maximum hardness of base metal, weld metal & HAZ of all the pressure containing parts shall not exceed 248 HV10. Hardness shall be recorded.

3.1.5 The carbon equivalent (CE) based on product analysis calculated by the formula shall not exceed 0.45 based on check analysis for each heat of steel used.

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

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3.1.6 The Manufacturer shall select materials as indicated in the data sheet along with the defined operating (Temperature/ Pressure) parameters and in accordance with ASME B 31.4/ B 31.8, as applicable and ANSI B16.25 for butt welding ends. Internal bore of weld joints shall not impede the pigging process or represent potential pig damage. The Manufacturer shall perform post weld heat treatment (PWHT) if required by the corresponding approved weld procedures. The Manufacturer shall prove by calculations to ASME VIII Division 1 that the materials supplied satisfy the pressure/temperature rating as specified in Data Sheet.

3.1.7 For Insulating Joint Specified to be used for Gas Service or LPG Service. Charpy V-notch test shall be conducted on each heat of steel used in manufacturing of the pressure containing parts including pipe pups and retainer ring of Insulating joint in accordance with ASTM A370. Unless otherwise stated Charpy V-notch test shall be conducted at 0°C or at lower temperature as specified in data sheet / material requisition. The specimens shall be taken in the direction of principal grain flow and notch perpendicular to original sample of plate or forging.

The minimum average absorbed impact energy value of the set of three (3) full size specimens tested at 0°C shall be 27J. The minimum impact energy value of any one specimen of three specimen analyzed as above shall not be less than 22J. Result of Charpy shall be recorded.

In case of Low Temperature Carbon Steel (LTCS) material specified in data sheet or offered manufacturers, the Charpy-V notch test requirement of applicable material standard shall be compiled with.

3.2 NON METALLIC COMPONENTS

Minimum thickness requirement of insulating material shall comply with NACE RP 0286.

Epoxy resin filler material used shall be CIBA Araldite CY-220 & Araldite HT-951 hardener or an approved equivalent.

Insulating rings (Spacing Ring) and joint filler material shall be flame resistant and capable of safely withstanding the maximum operating temperature without distortion or loss of insulating properties. Non-metallic seal materials, if provided, shall be resistant to amine-based corrosion inhibitors and explosive decompression.

The spacing ring shall be of epoxy glass fiber reinforced laminate. It shall possess high insulating properties that would comply with ASTM D 709 Type IV, Group G-11 properties. The materials compressive properties shall be equal to or greater than 450 MPa. The epoxy glass fiber laminates material shall possess anti-aging properties. The spacing ring, sealing gasket / Ring and filling material shall be resistant to flames and diffusion of gases, absorption of moisture and shall be capable of maintaining their required compressive strength and insulating properties over the design life of the pipeline.

Adhesive sealant or a low viscosity, cold curing thermosetting resin shall be used as filling material. Its compressive strength shall be equal to or greater than 150 MPa.

Plastic material shall be compatible to the materials they are in contact with. The Manufacturer shall give the details of the plastic used and its mechanical, chemical and temperature resistance properties.

3.3 INSULATING MATERIAL

- The design of insulating material shall conform to following requirements

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- The electric resistance does not decrease with time.
- The insulating material shall not deform.
- The insulating material shall be resistance to chemical attack by transferred fluid under design temperature and pressure.
- The transferred fluid does not penetrate into the structure of the insulating material under design conditions of pressure and temperature.

4.0 DESIGN AND MANUFACTURE

4.1 GENERAL

a. The monolithic insulating joints as per figure shall be designed so as to provide an effective electrical barrier by isolation between the buried pipeline and the above ground pipeline and other pipelines. Suitable for above or below ground installation as defined in the data sheet. The Manufacturer shall provide a proven design.

b. The insulating joints shall be of the monolithic bolt-less design comprising of forged sections assembled together by welding to form an integral unit. Insulating joint shall be fabricated by welding the forged retainer to pre-assembled insulating components and hub, under compression, so as to ensure effective sealing. Final assembly of joint shall be by welding only. Crimped and screwed closing joints are not permitted.

c. The hydrostatic test pressure for the insulating joints shall be 1.5 times the design pressure.

d. The insulating joints shall be designed for welding to the line pipe with weld ends. Bolted and flanged connections are not allowed.

e. The insulating joint shall have a smooth clear bore and be suitable for uninterrupted passage of all type pigs, spheres and on-line inspection tools. The internal bore of insulating joint shall match the bore of connected pipe as indicated in data sheet.

f. The design shall ensure that over the time of service the carrier product shall not permeate in the cavity.

g. The selected seal material shall be resistant to the chemicals and the operating temperature and pressure of the pipe system. At least 90% of the gasket shall be in contact with bare metal surface. The sealing gasket shall be of sufficient thickness and shall be made out of one piece of material, no joints are permitted.

h. **T**he insulating joint shall be able to sustain an internal vacuum of one (1) millibar.

i. No stress inducing recess, protrusions or notches, are permitted in the internal surface of the supplied joint. Additional fillers are not permitted to fill these flaws.

j. The cavities inside the joint shall be filled with low viscosity dielectric material that solidifies on curing. Air pockets and impurities in the dielectric material shall not be accepted.

k. The Manufacturer shall submit the detailed sectional drawing of the longitudinal face of the joint. The cross-sectional drawing shall show all parts, materials, dimensions surface finishes and tolerances.

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l. The electrical resistance of the joint shall not decrease with time. The joint shall include permanent terminals for survey lead connections.

m. The insulating joint material shall be resistant to creep.

n. The external fasteners shall be hot dip galvanized as per ASTM A 153.

4.2 DESIGN

4.2.1 MECHANICAL DESIGN

a. Main components of insulating joints such as forged hub, the stub end and the retainer ring, gaskets etc. shall be designed in accordance with Section VIII, Division 1, Appendix-2 of ASME, Boiler and Pressure Vessel Code. Design factor shall be in accordance with the data sheet.

b. Insulating joints shall be designed using the design principles of ASME Section VIII Div. 1. The design shall be checked for the following two cases:

CASE-1: Design pressure (as per Data Sheet) and Axial Force (F).

The Axial force shall be calculated as under:

F= 0.1 x S x A

Where S= SMYS of connected pipe (refer Data Sheet)

A= Metal cross-sectional area of connected pipe.

The allowable stress in this case shall be less than or equal to 0.5 x SMYS of insulating joint material.

CASE-2: Hydrostatic Test Design pressure

The allowable stress in this case shall be less than or equal to 90% of SMYS of insulating joint

material. All design parameters shall be as per Insulating Joint Data Sheet. Detailed design calculations shall be submitted for Company approval.

c. A corrosion allowance, as indicated in data sheets, shall be considered in design for operating condition.

d. Surfaces of the annular space between pup and retainer shall be abrasive blasted to a SA 2½ finish. Assembly of the insulating joint shall commence within two hours of completion of abrasive blasting. The annular space between the retainer and the spool shall be filled with epoxy resin.

e. The joint shall be assembled in a way that the internal components are firmly locked in position. The completed joint shall be capable of withstanding the operating and testing stresses. The neck of the bell shall be sealed with mastic. The design shall consider the position of the spacing ring, sealing gasket and filling material, so that the temperature of these materials remains below 60°C during tie-in welding operation.

4.2.2 PUPS

a. Insulating joints shall be supplied with pup pieces welded to each end by the Manufacturer. Pipe material used shall be as indicated in data sheets. The pup pieces shall be of equal length. The length of pup pieces shall be minimum 500mm or as specified on the data sheet.

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b. The end of the pups to be field welded shall be beveled in accordance with ASME B 31.4/31.8, as applicable. Pipe pups shall be welded to the insulation joint assembly prior to hydrostatic strength and leak testing.

c. When LSAW pipes are used as pups, the reinforcement of inside weld seam shall be removed for a distance of at least 50 mm from each end.

d. The joint between pipe pup pieces and main forging shall be full penetration butt weld type. Weld design shall be such as resulting in a weld joint factor of 1.0.

e. The tolerance on internal diameter and out of roundness at the ends for Insulating joints shall be as per applicable connected pipe specification as indicated in the Data Sheet.

4.2.3 ELECTRICAL

a. The average dielectric strength of the insulating joint shall be minimum 15 KV or more.

b. Two cleats/cable terminators shall be welded on pups on each side of insulating joint. The cleats shall be suitable for connecting 10mm² and 50mm² cables for measurement/shorting purposes. Cleat Shall be attached to Insulating joint by welding. Refer Fig 4.1 for details.

4.2.4 WELDING

a. All welds except closing weld shall be butt welds. The closing weld shall be full penetration girth weld in accordance with ASME BPVC Section VIII, Division 1. The weld design shall conform to the ASME acceptable standards. Fillet welds if required, shall have minimum two passes.

b. Butt weld end shall have end prepared as per ASME B 16.25. However, end preparation for butt welding end having unequal thickness w.r.t connecting Pipe, shall be shall be prepared in accordance with ASME B31.4/ B31.8, as applicable. All butt weld ends shall be checked for surface defects using dye penetrate (As per Appendix 8 of ASME Section VIII) prior to welding.

c. All welding shall be carried out by welders and welding procedure qualified in accordance with ASME Section IX. The procedure quantification to include hardness and impact test shall meet the requirement of clause 3.1.4 & 3.1.7.

d. No repairs by welding shall be carried out on base metal of any component of insulating joint. Manufacturer shall obtain Purchaser approval prior to carrying out any repair of welds. The repair welding shall be carried out by welders and welding procedures duly qualified per ASME Section IX and records for each repair shall be maintained. Welding procedure and repair welding procedure qualification shall include requirements for impact testing & hardness test when required as per Clause 3.1.4 & 3.1.7 of this specification and shall meet the requirement therein. Radiography shall be performed after the repair

e. Cold die stamping on insulating joints or pups is not permitted on the body. Cold die stamping can be done on the pipe bevel.

f. The repair of the forging by welding is not permitted. All production welding, including tacking shall be done as per the qualified procedure by the qualified welder/ operators. The acceptable weld processes are:

- Shielded Metal Arc Welding (SMAW)
- Submerged Arc Welding (SAW)

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- Gas Metal Arc Welding (GMAW)

g. The Manufacturer shall ensure that all the mechanical works are completed prior to the post weld heat treatment and hydrostatic test. Any re-work (welding, cutting and grinding) on the surface of the material after the PWHT or hydrostatic testing is not permitted.

h. The need for Post Weld Heat Treatment (PWHT) shall be assessed by the Manufacturer in accordance with the relevant weld procedure.

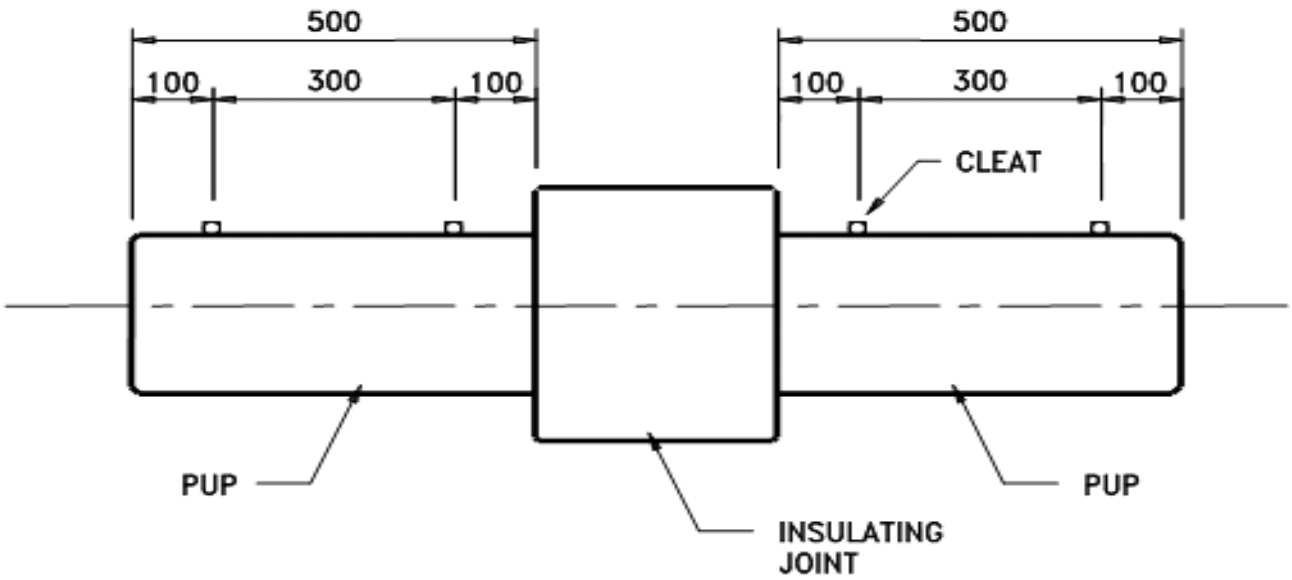

FIG. 4.1

5.0 INSPECTION AND TESTS

The Manufacturer shall ensure all equipment used for testing and inspection purposes is calibrated and certified accordingly. The Manufacturer shall record all inspection and testing activity on the appropriate inspection certificate. The following minimum inspection and testing shall be carried out prior to painting, marking and shipment of insulating joints.

5.1 TESTING OF MATERIALS

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard as referred to in this specification.

5.2 VISUAL INSPECTION AND DIMENSIONAL CHECK

All insulating joints shall be visually inspected for visible surface defects and compliance with related documents. The Internal The internal and external surfaces shall be free from any strikes, gouges and other detrimental defects Bevels at butt weld ends shall show a smooth contour. All dimensions shall be checked for conformance with approved drawings.

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5.3 NON-DESTRUCTIVE EXAMINATION

As a minimum all NDT shall be performed in accordance with ASME Section V and examination according to ASME Section VIII or as defined herein.

a. Full length of all pressure containing butt welds, including welds that have been repaired, shall be examined 100% by radiography. Acceptance limits shall be as per API 1104

b. Any other weld that, in Purchaser's opinion, cannot be radiographed shall be inspected by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix 12 and Appendix 6 respectively. Root pass of joint closure weld shall be examined by magnetic particle inspection method.

c. All forging shall be wet magnetic particle inspected on 100 % of forged surface. Method of inspection and acceptance shall comply MSS-SP-53.

d. All finished weld ends shall be 100% ultrasonically tested for lamination type defects for a distance of 50 mm from the ends. Any lamination larger than 6.35 mm shall not be acceptable.

e. All fillet welds shall be non-destructively examined as follows:

Fillet thickness < 6 mm	:	100% by magnetic particle inspection, acceptance criteria as per ASME Sec VIII Appendix 6.
Fillet Thickness ≥ 6 mm	:	100% by Ultrasonic Testing, acceptance criteria as per ASME Sec VIII Appendix 12 respectively.

f. All NDT shall result shall documented and be available for Purchasers review.

5.4 HYDROSTATIC TEST

A hydrostatic test shall be carried out on each insulating joint complete in all respects. The test pressure as indicated in data sheets shall be held for a period of 15 min and the assembly visually inspected for leaks. Any pressure changes must correspond with temperature changes otherwise the test will not be acceptable. Test records to be maintained accordingly by Manufacturer.

After hydrostatic test, insulating joints shall be tested with air at 5 kg/cm^2 for 10 minutes. The tightness shall be checked by immersion or with a frothing agent. No leakage will be accepted.

5.5 DIELECTRIC TEST

Insulation resistance of each insulating joint shall be at least 25 Mega Ohms, when checked with 500-1000 V DC.

In addition, prior to and after hydro testing, each insulating joint shall be tested for dielectric integrity at 5000 V AC, 50 Hz for one minute and the leakage current before and after the hydrostatic test shall be equal. Testing time, voltage and leakage shall be recorded and certified.

No repair shall be permitted to the insulating joints failed in the above-mentioned tests.

Company reserves the right to perform stage wise inspection and witness tests as indicated in clause 5 at Manufacturer's Works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection by the Company's Inspector. Inspection and tests performed/witnessed by the Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

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6.0 PAINTING

SURFACE PREPARATION

Surface preparation for all coated surfaces according standard SSPC-SP-10 by shot blasting

PAINTING

Exterior surfaces of all insulating joints shall be painted with a non-conducting epoxy, three layer paint coating system. The internal lining shall be of a two-pack (solvent free) non-conducting epoxy compound (cold or hot curing).

The internal coating shall be suitable for the service and design conditions indicated in data sheets, and shall neither be damaged by or cause damage to pipeline pigs including inspection and scraper pigs.

The internal and external coating/lining shall be cut back by 75mm from the weld-edge. Coating system and procedure shall be approved by Purchaser prior to manufacture.

7.0 MARKING

All insulating joints shall be fitted with a stainless-steel name plate with following markings die stamped or raised letters in metric units:

- Manufacturer's Name.
- Suitable for _____Inch Nominal Diameter Pipeline.
- End Thickness in mm.
- Material.
- Design Pressure / Hydrostatic Test Pressure.
- ANSI Class Rating.
- Tag No.
- Year of Manufacture.

8.0 TEST CERTIFICATES

Manufacturer shall submit following certificates to Company's inspector:

- Test certificates relevant to the chemical analysis and mechanical properties of the materials used for construction of insulating joint as per this specification and relevant standards.
- Test reports on non-destructive testing.
- Test certificates for hydrostatic and air tests.
- Test certificate for electrical tests.

9.0 PACKING & SHIPPING

All butt weld ends shall be suitably protected to avoid any damage during transit by means of metallic or high impact plastic bevel protectors; and all assemblies shall be cleaned from inside of all foreign materials, grease, rust etc. prior to packing. Prior to shipment, parts and equipment which have bare metallic surfaces shall be protected with a rust preventative which will provide protection at temperatures up to 50°C. Sealing surfaces and moving parts to have a graphite grease coating applied.

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The Manufacturer shall supply packing and shipping procedure with the tender. All Insulation joints shall be packed and prepared for shipment/transport in accordance with the procedures included in the Request for Quotation (RFQ) documentation, subsequently approved by the Purchaser.

Only those insulating joints, which have been inspected and certified by Company's Inspector,shall be shipped.

10.0 DOCUMENTATION

Documentation to be submitted by Manufacturer to Company is summarized below. Number of Copies (Hard copies / soft copies etc.) shall be as indicated in CONTRACT document.

10.1 At the time of bidding, Bidder shall submit the following documents:

- Reference list of similar supplies including all relevant details viz. Project, Year of supply, Client, Location, Size, Rating and Service for the last seven years.

10.2 After placement of order, the Manufacturer shall submit the following drawings, documents and specifications for company's review and information:

- General arrangement drawings of flow tees with overall dimensions and cross-sectional drawing including relevant calculations for pressure containing parts.

10.3 All documents shall be in English Language.

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ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION

FOR
PIG SIGNALLERS

VPC – SS – PP - 2030

00	28.01.2020	MB	MD	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
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REVISION RECORD						
Rev.	**Revision Date**	**Prepared by**	**Checked by**	**Approved by**	**Authorized by**	**Revision Description**
00	28.01.2020					
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ABBREVIATIONS:

ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
BHN	Brinell hardness number
HAZ	Heat Affected Zone
MSS-SP	Manufacturers Standardization Society - Standard Practice
RTJ	Ring Type Joint
SSPC	Steel Structures Painting Council

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1.0 SCOPE

This specification covers the minimum requirements for the design, manufacture, testing and supply of Pig Signallers (Intrusive type), used for the detection of passage of pig and instrumented gauging pigs, to be installed in onshore pipelines transporting non-sour hydrocarbons in liquid or gaseous phase including Liquefied Petroleum Gas (LPG).

2.0 REFERENCE DOCUMENTS

The design, fabrication and supply of Pig Signallers shall comply with the latest edition of the following codes and standards.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

B31.4	:	Pipeline Transportation system for liquid Hydrocarbon & other liquids.
B 31.8	:	Gas Transmission and Distribution Piping Systems.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A370	:	Standard Test Methods and Definitions for Mechanical Testing of Steel Products.

STEEL STRUCTURES PAINTING COUNCIL (SSPC)

VIS-I	:	Visual Standard.

OIL INDUSTRY SAFETY DIRECTORATE (OISD)

Std. 141	:	Design and Construction Requirements for Cross Country Hydrocarbon Pipelines.
Std. 226	:	Natural gas Transmission Pipelines and city gas distribution network.

MISCELLANEOUS

IEC	:	International Electro technical Commission
NEMA	:	National Electrical Manufacturer's Association
NEC	:	National Electric Code

In case of conflict between various requirements of this specification and reference standards mentioned above, more stringent requirement shall apply unless otherwise agreed by Purchaser.

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3.0 MATERIALS

3.1.1 Material for major components of the Pig Signallers shall be as indicated in Pig Signaller Data Sheet. Material of components not specified in data sheet shall be as per Manufacturer's Standard suitable for the service conditions indicated in Data Sheet, which will be subject to approval by Company. In addition, the material shall also meet the requirements specified hereinafter.

3.1.2 Carbon Steel used in the manufacture of Pig Signallers shall be fully killed.

3.1.3 Seal materials used that are exposed to pipeline contents shall be resistant to amine based corrosion inhibitors and explosive decompression.

3.1.4 Scarfed welding base shall have Carbon Equivalent (CE) not greater than 0.45% on check analysis calculated as per the following formula:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

3.1.5 For Pig Signaller specified to be used for gas service or LPG Service, hardness test shall be carried out as per ASTM A370 for each heat of steel used full thickness cross section shall be taken for this purpose. The maximum hardness of base metal, weld metal & HAZ of all the pressure containing parts shall not exceed 248 HV10.

3.1.6 For Pig Signaller Specified to be used for Gas Service or LPG Service. Charpy V-notch test shall be conducted on each heat of steel used in manufacturing of the pressure containing parts in accordance with ASTM A370. The specimens shall be taken in the direction of principal grain flow and notch perpendicular to original sample of plate or forging.

Charpy Impact test shall be carried out at -29°C temperature as stated in data sheet. If not stated in data sheet, the minimum average absorbed impact energy value of the set of three (3) full size specimen tested at 0°C shall be 27J. The minimum impact energy value of any one specimen of three specimen analyzed as above shall not be less than 22J.

In case of low temperature Carbon steel (LTCS) material specified in data sheet or offered manufacturers, the Charpy-V notch test requirement of applicable material standard shall be compiled with.

4.0 DESIGN AND MANUFACTURE

4.1 Pig Signaller shall be suitable for welding on to pig trap and pipe having material, diameter, wall thickness and service condition indicated in the data sheets.

4.2 Pig Signallers shall be bi-directional type. Plunger type Pig-Signallers is not acceptable.

4.3 All Pig Signallers shall have spring loaded visual indicator with manual reset. Flag shall get locked in down position when reset. In addition, Pig Signallers shall be provided with a micro-switch, duly encased in a weatherproof and explosion proof enclosure, for remote indication when indicated in data sheets. The electrical rating and area classification of micro-switch shall be as per data sheet.

4.4 Aboveground and underground installation shall be as stated in the data sheet. For

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underground installation Pig Signallers shall be provided with extension, so that visual indicator is located well above the ground. The length of extension shall be as indicated in data sheet and shall be measured from pipe centerline to hinge of the visual indicator. All components connecting visual indicator and trigger mechanism shall be enclosed in weatherproof enclosure.

4.5 The seals used for Pig Signallers shall be able to withstand an internal vacuum of 5-millibar.

4.6 Pig Signallers indicated in data sheets to be installed on pipeline shall be provided with a built-in valve to allow replacement/repair of internals with line under pressure. Pig Signallers indicated to be used on pig traps shall be with or without built in isolation valve as specified in datasheet.

4.7 All welds shall be made by welders and welding procedures qualified in accordance with the provisions of ASME Section IX.

5.0 INSPECTION AND TESTS

The Manufacturer shall perform all inspections and tests as per the requirements of this specification and the relevant codes, standards and specifications, prior to shipment at his Works. Such inspections and tests shall be, but not limited to, the following:-

5.1 CHEMICAL COMPOSITION AND MECHANICAL TEST

Chemical composition and mechanical tests including yield strength, ultimate tensile strength, Impact test, elongation and hardness shall be carried out for each heat of steel used as per the applicable standard referred to in the corresponding Material Specification.

5.2 VISUAL INSPECTION

All Pig Signallers shall be visually inspected. The internal and external surfaces shall be free from any strikes, gouges and other detrimental defects. The surfaces shall be thoroughly cleaned and free from dirt, rust and scales.

5.3 HYDROSTATIC TEST

A hydrostatic test shall be carried out on each Pig Signaller after assembly. The test pressure as indicated in data sheets shall be held for a period of 15 minutes. No visible leakage or drop in pressure permitted.

5.4 NON-DESTRUCTIVE EXAMINATION

a. Full length of all pressure containing welds, including welds that have been repaired, shall be inspected by ultrasonic or magnetic particle methods. Acceptance criteria shall be as per ASME Section VIII Appendix U and Appendix VI.

b. Wet Magnetic Particle Inspection of all bevel surfaces shall be carried out for all Pig Signallers. Any lamination extending into bevel face and having transverse dimension greater than 6.4 mm shall not be acceptable.

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5.5 FUNCTIONAL TEST

Manufacturers shall perform functional tests to establish satisfactory performance of both manual and electrical indications.

5.6 Company's Inspector reserves the right to perform stage wise inspection and witness tests, including hydrostatic test, as indicated in specification, at Manufacturer's Works prior to shipment. Manufacturer shall give reasonable notice of time and shall provide without charge reasonable access and facilities required for inspection, to the Company's Inspector.

Inspection and tests performed/witnessed by Company's Inspector shall in no way relieve the Manufacturer's obligation to perform the required inspection and tests.

6.0 PAINTING

6.1 SURFACE PREPARATION

Surface preparation for all coated surfaces according to coating Manufacturers recommended or to SSPC-SP-10 surface preparation for coating as a minimum.

6.2 ABOVE GROUND PAINTING

Pig Signaller exterior surfaces shall be painted with a three layer epoxy paint coating system. The Manufacturer has to provide paint procedure for approval prior to manufacture.

6.3 BELOW GROUND COATING

Pig Signaller exterior surfaces that will be buried below ground shall be coated with three coats of coal tar epoxy resin with a minimum dry film thickness of 400 microns.

7.0 MARKING

All Pig Signallers shall be marked with following information on corrosion resistant metal tag permanently attached to the pig signaler:-

- Manufacturer’s name.
- Suitable for Welding on ---------- dia pipe.
- Tag Number.
- ANSI Rating.
- Material and grade.
- Test Pressure.
- Year of Manufacture.

8.0 TEST CERTIFICATES

Manufacturer shall submit the following test certificates:

- Test certificates for material compliance as per relevant material standards.
- Test certificates of hydrostatic and functional tests.
- Test reports of NDT.

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9.0 PACKING & SHIPPING

All Pig Signallers shall be packed and prepared for shipment/transport in accordance with the procedures included in the request for Quotation (RFQ).

Butt weld ends of all Pig Signallers shall be suitably protected to avoid any damage during transit.

All machined surfaces subject to corrosion shall be well protected by a coat of grease or other suitable materials.

10.0 SPARES AND ACCESSORIES

Manufacturer shall furnish list of recommended spares and accessories for Pig Signallers required during start-up and commissioning and supply of such spares shall be included in the price quoted by Manufacturer.

Manufacturer shall furnish list of recommended spares and accessories (including jacketing bracket) required for two years of normal operation and maintenance of Pig Signallers and price for such spares shall be quoted separately.

11.0 CERTIFICATION

All Certification of finished product shall be EN 10204 type 3.2.

12.0 DOCUMENTATION

The Manufacturer shall supply documentation in accordance with the Vendor Data Requirements List (VDRL) as attached with Purchase Order.

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