REGISTERED No. M - 302
L.-7646

The Gazette of Pakistan

EXTRAORDINARY
PUBLISHED BY AUTHORITY

ISLAMABAD, FRIDAY, JULY 3, 2009

PART II

Statutory Notifications (S.R.O)

GOVERNMENT OF PAKISTAN

OIL AND GAS REGULATORY AUTHORITY

NOTIFICATION

Islamabad, the 2nd July, 2009

S.R.O.622(I)/2009.-In exercise of the powers conferred by Section 42 of Oil and Gas Regulatory Authority Ordinance, 2002 (Ordinance XVII of 2002) the Oil and Gas Regulatory Authority is pleased to make the following regulations namely:-

1. Short title and Commencement:- (1) These Regulations may be called the Oil Transportation (Pipeline) Technical Standards

(2) They shall, come into force at once.

2. Applicability:- These regulations shall be applicable to all such licencees undertaking the regulated activity for transportation of petroleum products through pipeline.

3. GLOSSARY

3.1 Definition of General terms

In this Standard the following terms shall have the meaning ascribed thereto below:

3.1.1 "Defect" means an imperfection of sufficient magnitude to warrant rejection.

3.1.2 “Engineering design” means the detailed design developed from operating requirements and conforming to Code requirements, including all necessary drawings and specifications, governing a piping installation

3.1.3 “General corrosion” means the uniform or gradually varying loss of wall thickness over an area.

3.1.4 “Girth weld” means a complete circumferential butt weld joining pipe or components.

3.1.5 “Imperfection” means a discontinuity or irregularity which is detected by inspection

3.1.6 “Internal design pressure” means internal pressure used in calculations or analysis for pressure design of a piping component

3.1.7 “Maximum steady state operating pressure” means maximum pressure (sum of static head pressure, pressure required to overcome friction losses, and any back pressure) at any point in a piping system when the system is operating under steady state conditions.

3.1.8 “Operating company” means owner or agent currently responsible for the design, construction, inspection, testing, operation and maintenance of the piping system.

3.1.9 “Pipe” means a tube, usually cylindrical, used for conveying a fluid or transmitting fluid pressure, normally designated “pipe” in the applicable specification. It also includes any similar component designated as “tubing” used for the same purpose.

3.1.10 “Pressure”, unless otherwise stated, pressure is expressed in pounds per square in (bar) above atmospheric pressure i-e gauge pressure as abbreviated – psig (bar)

3.1.11 “Arc welding” means a group of welding process wherein coalescence is produced by heating with an electric arc or arcs, with or without the application of pressure and with or without the use of filler metal.

3.1.12 “Automatic welding” means welding with equipment which performs the entire welding operation without constant observation and adjustment of the controls by and operator. The equipment may or may not perform the loading and unloading of the work.

3.1.13 “Fillet work” means a weld of approximately triangular cross section joining two surfaces approximately at right angles to each other in a lap joint, tee joint, or corner joint

3.1.14 “Full fillet weld” means a fillet weld whose size is equal to the thickness of the thinner member joined

3.1.15 “Gas welding” means a group of welding processes wherein coalescence is produced by heating with a gas flame or flames, with or without the application of pressure, and with or without the use of filler metal

3.1.16 “Gas metal arc welding” means an arc welding process wherein coalescence is produced by heating with an electric arc between a filler metal (consumable) electrode and the work. Shielding is obtained from a gas, a gas mixture (which may contain and inert gas), or a mixture of a gas and a flux(this process has sometimes been called Mig welding or CO2 welding)

3.1.17 “Gas tungsten arc welding” means an arc welding process wherein coalescence is produced by heating with an electric arc between a single tungsten (noncombustible) electrode and the work. Shielding is obtained from a gas or gas mixture (which may contain an inert gas). Pressure may or may not be used and filler metal may or may not be used. (this process has sometimes been called Tig welding)

3.1.18 “Semiautomatic arc welding” means arc welding with equipment which controls only the filler metal feed. The advance of the welding is manually controlled

3.1.19 “Shielded metal or welding” means an arc welding process wherein coalescence is produced by heating with an electric arc between a covered metal electrode and the work. Shielding is obtained form decomposition of the electrode covering. Pressure is not used and filler metal is obtained from the electrode.

3.1.20 “Submerged arc welding” means an arc welding process wherein coalescence is produced by heating with an electric arc or arc between a bare metal electrode or electrodes and the work. The welding is shielded by a blanket of granular, fusible material on the work. Pressure is not used, and filler metal is obtained from the electrode and sometimes form a supplementary welding rod.

3.1.21 “Tack weld” means a weld made to hold parts of a weldment in proper alignment until subsequent welds are made.

3.1.22 “Weld” means a localized coalescence of metal wherein coalescence is produced by heating to suitable temperatures, with or without the application of pressure and with or without the

use filler metal. The filler metal shall have a melting point approximately the same as the base metal

3.1.23 "Welder" means one who is capable of performing a manual or semiautomatic welding operation

3.1.24 "Welding procedures" means the detailed methods and practices including joint welding procedures involved in the production of a weldment.

4. SCOPE

4.1 GENERAL

This standard covers the design, material, construction, assembly, inspection, testing, operation and maintenance of an oil pipeline system between producers lease facilities, tank farms, refineries, station, terminals (Marine, Rail and Truck) and other delivery and receiving points. The pipeline shall be considered to consist of the following:

- Pipe;
- Flanges;
- Bolting;
- Gaskets;
- Valves;
- Relief devices;
- Fitting;
- Pressure containing parts of the other piping systems;
- Block valve assembly; and
- Strainer.

Only pipelines designed for internal pressures of above 15 Psi (1 bar) in a temperature range of 20 ˚F (-30 ˚C) to 250 ˚F (120 ˚C) lie within the scope of this document. Also included within the scope of this document are:

a. Primary and associated auxiliary liquid petroleum piping at pipeline terminals, tank farms and pump stations;

b. Storage and working tanks; including pipe-type storage fabricated from pipe and fittings, and piping interconnecting these facilities.

c. Liquid petroleum piping located properly which has been set aside for such pipeline within a petroleum refinery;

d. Those aspects of operation and maintenance of liquid pipeline systems relating to the safety and protection of the general public;

5. DESIGN

5.1 GENERAL

The piping must be designed with sufficient wall thickness considering the effect of pressure and temperature both external and internal.

5.2 INTERNAL DESIGN PRESSURE

The piping component at any point in the piping system shall be designed for an internal design pressure which shall not be less than the maximum steady state operating pressure at those points, or less than the static heads pressure at that point with the line in a static condition.

The internal design pressure, Pi of pipes shall be calculated by the following equation:

$$t = PiD/2S \{t=PiD/20S\}$$

Where

t = Pressure design wall thickness calculated in inches (mm);
Pi = Internal design gauge pressure psi (bar);
D = Outside diameter of pipe, inches (mm);
S = Applicable allowable stress value psi (MPa);

Internal design pressure shall not in any case less than the maximum steady state head pressure.

5.3 DESIGN TEMPERATURE

The design temperature is the metal temperature expected in normal operation. It is not necessary to vary the design stress for metal temperatures between -20 ˚F (-30 ˚C) and 250 ˚F (120 ˚C)

5.4 ALLOWANCES FOR VARIATIONS FROM NORMAL OPERATIONS

Surge calculations shall be made, and adequate controls and protective equipment shall be provided, so that the level of pressure rise due to surges and other variations from normal operations shall not exceed the internal design pressure at any point in the piping system and equipment by more than 10%.

5.5 ALLOWABLE STRESS VALUES

The allowable stress value S to be used for design calculations for new pipe of known specification shall be established as follows:

S = 0.72 x E x specified minimum yield strength of the pipe, psi

E = Weld joint factor

5.6 FITTINGS

(a) Steel Butt Welding Fittings:

When steel butt welding fittings are used, they shall comply with ANSI B-16.9, ANSI B-16.28 or MSS SP-75

(b) Flanges and Flange Accessories:

i. Flange or Flange-accessories must meet the minimum requirements of ANSI B-16.5, MSS SP-44 or the equivalent;

ii. Flange assembly must be able to withstand the maximum pressure at which the pipeline is operated and to maintain its physical and chemical properties at any temperature that it might be subjected to;

iii. Each flange on a flanged joint in cast iron pipe must conform in dimensions, drilling, face and gasket design to ASME B-16.1 and be cast integrally with the pipe, valve or fitting;

5.7 WELDED BRANCH CONNECTIONS

Welded branch connection made to pipe in the form of a single connection; or in a header or manifold as a series of connections must be designed to ensure that the strength of the pipeline system is not reduced, taking into account the stress in the remaining pipe wall due to the opening in the pipe of header, the shear stresses produced by the pressure acting on the area of the branch opening, and any external loadings due to thermal movement, weight and vibration.

5.8 EXPANSION AND FLEXIBILITY

Piping shall be designed to have sufficient flexibility to prevent expansion or contraction from causing excessive stresses in the piping material, excessive bending movements at joints, or excessive forces or moments at points of connection to equipment or at anchorage or guide points. Allowable forces and moments on equipment may be less than for the connected piping.

6. MATERIALS

6.1 GENERAL

(a) All materials and equipment that would become a permanent part of any piping system shall be suitable and safe for the conditions under which they are to be used;

(b) This section prescribes minimum requirements for the selection and qualification of pipe and components, for use in pipelines;

(c) Material for pipe and components must be:

i. able to maintain the structural integrity of the pipeline under its design conditions;

ii. chemically compatible with the fluid that is to be transported through it.

6.2 STEEL PIPE MATERIAL STANDARD

Steel pipe manufactured in accordance with the following standards may be used or shall meet the requirements of ASME B-31.4

API	5L	Line Pipe
API	5LU	Ultra high test heat treated line pipe
ASTM A	53	Welded and seamless pipe
ASTM A	106	Seamless Pipe
ASTM A	134	Electric Fusion (Arc) Welded Pipe
ASTM A	135	Electric Resistance Welded Pipe
ASTM A	139	Electric Fusion (Arc) Welded Pipe
ASTM A	333	Seamless and Welded Pipe for low temperature service
ASTM A	381	Metal Arc Welded Pipe
ASTM A	671	Electric Fusion Welded Pipe
ASTM A	672	Electric Fusion Welded Pipe

6.3 MARKING OF MATERIALS

(a) Each valve, fitting, length of pipe and other components must be marked:
   (i) as prescribed in the specification or standard to which it was manufactured;
   (ii) to indicate size, material, manufacturer, pressure rating and temperature rating and as appropriate type, grade and model.

(b) Surface of pipe and components that are subject to stress from internal pressure may not be field die stamped.

(c) If any item is marked by die stamping, the die must have blunt or rounded edges that will minimize stress concentrations.

Note: All material and components e.g. steel pipe, flanges, valves, gaskets, bolting etc must conform to the specification, which should not be taken as exhaustive. The Oil Company may at its own discretion, choose an equivalent or superior specification to suit the application.

7. CONSTRUCTION

7.1 GENERAL

Each pipeline must be constructed in accordance with comprehensive written specification or standards that are consistent with the documents. Whether covered specifically or not, all construction and materials shall be in accordance with good engineering, safety and proven pipeline practice.

7.2 INSPECTION

Construction inspection provisions for pipelines and related facilities shall be adequate to assure compliance with the material, construction, welding, assembly and testing requirement of this standard.

7.3 QUALIFICATION OF INSPECTOR

Inspector personnel shall be qualified by training and experience. Such personnel shall be capable of performing the following inspection series:

(i) Right of way and grading;
(ii) Ditching;
(iii) Line up and pipe surface inspection;
(iv) Welding;
(v) Coating;
(vi) Tie-in and lowering;
(vii) Backfilling, compaction and cleanup;
(viii) Pressure testing;
(ix) Special services for testing and inspection of facilities such as station construction, river crossings, electrical installation, radiography, corrosion control etc as may be required.

7.4 RIGHT OF WAY

Pipe route should be selected so as to minimize the possibility of hazard from future industrial or urban development, encroachment of the right of way or line routing and damage to environmental by sensitive or archeological and historical sites.

7.5 CONSTRUCTION REQUIREMENTS

(a) Inconvenience to the land owner/resident should be minimized and safety of the public shall be given prime consideration.

(b) All blasting shall be in accordance with the governing regulations and shall be performed so as to provide adequate protection to the general public, livestock, wildlife, building, telephones, telegraph, power lines, underground structures and any other property in the proximity of the blasting.

(c) In grading the right of way, every effort shall be made to minimize damage to the land and prevent abnormal drainage and erosive conditions. The land is to be restored to as nearly original condition as is practical. In constructing pipeline crossing of railroads, highway, streams, lakes, rivers, etc safety precaution such as sign, light, guard rails, supporting structures etc shall be maintained in the interest of public safety. The crossing shall comply with the applicable rules, regulation and restrictions of regulatory bodies having jurisdiction.

7.6 SURVEY, STAKING AND MARKING

The route shall be surveyed and staked, and such staking and marking should be maintained during construction. The pipeline shall be properly located within the right of way by maintaining survey route marker or by survey given during construction.

7.7 HANDLING, HAULING, STRINGING AND STORING

Care shall be exercised in the handling or storing of pipe casing, coating materials, valves, fittings and other materials to prevent damage. When applicable, railroad transportation of pipe shall meet the requirements of API RP 5L1. In the event, pipe is yard coated or mill coated, adequate precautions shall be taken to prevent damage to the coating when hauling, lifting and placing on the right of way. Pipe shall not be allowed to drop and strike objects which will distort, dent, flatten, gauge or notch the pipe or damage the coating, but shall be lifted or lowered by suitable and safe equipment.

7.8 DITCHING

(a) Depth of ditch shall be appropriate for the route location, surface use of the land, terrain features and loads imposed by road ways and railroads. All buried pipelines shall be installed with a minimum cover not less than that specified in this standard. Where the cover provisions cannot be met, pipe may be installed with less cover if additional protection is provided to with stand anticipated external forces.

(b) Width and grade of ditch shall provide for lowering of the pipe into the ditch to minimize damage to the coating and to facilitate fitting the pipe in the ditch.

(c) Location of underground structures intersecting the ditch route shall be determined in advance of construction activities to prevent damage to such structures. A minimum clearance of 12 inch (0.3m) shall be provided between the outside of any buried pipe or component and the extremity of any other underground structures, except for drainage tile which shall have a minimum clearance of 2 inch (50 mm).

(d) Ditching operations shall follow good pipeline practice and consideration of public safety. API RP 1102 provides information on railroad and highway crossings.

7.9 INSTALLATION OF PIPE IN THE DITCH

On pipelines operating at hoop stress of 20% or more of the specified minimum yield strength, it is important that stresses induced into the pipeline by construction be minimized. The pipe shall fit the ditch without the use of external force to hold it in place until the backfill is completed. When long section of pipe that have been welded alongside the ditch are lowered, care shall be exercised so as not to jerk the pipe or impose any strains that may kink or put a permanent bend in the

pipe. Slack loops are not prohibited by this paragraph when laying conditions render their use advisable.

7.10 PROTECTION FROM HAZARDS

(a) The company must take all practicable steps to protect each pipeline from washouts, floods, unstable soils landslide or other hazards that may cause the pipeline to move or to sustain abnormal loads.

(b) Each aboveground line, not located offshore or in inland navigable water areas, must be protected from accidental damage by vehicular traffic or other similar cause other by placing it at a safe distance from the traffic or by installing barricades.

7.11 UNDERGROUND CLEARANCE

Each line must be installed with at-least 12 inches (300 mm) of clearance from any other underground structure not associated with the oil line. If this clearance cannot be attained the oil line must be protected from damage that might result from proximity to either structures.

7.12 BACKFILLING

(a) Back filling shall be performed in a manner to provide firm support under the pipe.

(b) If there are large rocks in the material to be used for backfill, care shall be taken to prevent damage to the pipe & coating by such means as the use of a rock shield material or by making the initial fill with rock free material sufficient to prevent rock damage.

(c) Where the ditch is flooded, care shall be exercised so that pipe is not floated from the bottom of the ditch prior to backfill completion.

7.13 TIE-IN-JOINT

Gaps left in the continuous line construction at such points as river, canal, highway, or railroad crossings require special consideration for alignment and welding. Sufficient equipment shall be available and care exercised not to force or strain the pipe to proper alignment.

7.14 BLOCK AND ISOLATING VALVES

Block and isolating valves shall be installed for limiting hazard and damage from accidental discharge and for facilitating maintenance of the piping system. Valves shall be at accessible locations, protected from damage or tempering, and suitably supported to prevent differential settlement of the attached piping. Where an operating device to closed valve is provided, it shall be protected and accessible only to authorized persons. Pipeline valves on offshore platforms shall be located for easy

access to permit isolation of the piping system. Submerged valves on pipelines shall be marked or spotted by survey techniques to facilitate quick location when operation is required.

7.15 SCRAPER TRAPS

Scraper traps are to be installed as deemed necessary for good operations. All pipe, valves, fittings, closures, and appurtenances shall comply with appropriate section of this document. Scraper traps on mainline terminations and tied into connection piping or manifolding shall be anchored below ground with adequate concrete anchors when required and suitably supported above ground to prevent transmission of line stresses due to expansion and contraction to connecting facilities.

7.16 COVER REQUIREMENTS

Buried pipeline shall be installed with a cover not less than that shown in the following table:

MINIMUM COVER FOR BURIED PIPELINES

Location	Normal Excavation in Inches (m)	Rock Excavation in Inches (m)
Industrial, Commercial & Residential Areas	36 (0.9)	24 (0.6)
River & stream crossings	48 (1.2)	18 (0.45)
Drainage ditches at Roadways & Railroads	36 (0.9)	24 (0.6)
Any other Area	30 (0.75)	18 (0.45)

7.17 STEEL PIPELINES CROSSING RAILROADS AND HIGHWAYS PROVISION FOR SAFETY

The applicable regulation of Federal, provincial, municipal or other regulatory bodies having jurisdiction over the pipeline or facility to be crossed shall be observed for the installation of a crossing. Pipeline must cross the railroads or highways perpendicular or as close perpendicularly as possible, uncased crossing are preferred. Whether cased or uncased, there should be no void between the line (or the casing) and the soil. Installed casing must slope towards one end with a minimum slope of 1:100. Following table gives the minimum wall thickness allowed for casing pipe and for uncased carrier pipe crossing highways and railways. Where the requirements of railways, highways, or the design calculations stipulate high values they must be used. Particular attention should be given to other governmental codes:

Least Nominal Wall Thickness for steel casing and carrier pipe in uncased crossing

NPS (Inches)	HIGHWAYS (Inches)	RAILWAYS (Inches)
3	0.125	0.125
4	0.125	0.125
6	0.188	0.188

8	0.188	0.188
10	0.188	0.188
12	0.188	0.188
14	0.188	0.219
16	0.188	0.219
18	0.188	0.250
20	0.188	0.281
22	0.220	0.312
24	0.250	0.344
26	0.250	0.375
28	0.250	0.406
30	0.250	0.406
32	0.250	0.438
34	0.250	0.469
36	0.250	0.469
38	0.312	0.500
40	0.312	0.500
42	0.312	0.500
44	0.312	0.578
46	0.312	0.625
48	0.312	0.625
50	0.344	0.625

Table 7.1 (1 inch = 25.4mm)

7.18 UNCASED RAILWAY CROSSINGS

It shall be permissible to install uncased steel pipelines under railways, provided that:

(a) The pipe must be designed to sustain the loads.

(b) For uncased crossings, the carrier pipe D/t ratio must not exceed the figures given in table.

(c) For steel pipe with a joint factor of 1.0 hoop stress in the carrier pipe must not exceed 50% SMYS for primary track crossings.

(d) For steel pipe with a joint factor, less than 1.0 hoop stress in the carrier pipe must not exceed 30% SMYS for primary track crossings.

(e) For secondary and industrial track crossings, steel pipe with a joint factor less than 1.0, the SMYS in the carrier pipe must not exceed 50%.

(f) The pipe nominal wall thickness is not less than the minimum calculated from the design formula, or the minimum wall thickness given in the table.

MAXIMUM PIPE DIAMETERS TO WALL THICKNESS (D/T) RATIO FOR UNCASED RAILWAY AND HIGHWAY CROSSING

Maximum D/T Ratio								
Maximum operating Pressure (Psi)	Steel Pipe Grade							
	35	42	46	52	56	60	65	70
2000	15	20	22	25	27	29	32	34
1900	16	21	23	26	29	31	33	36
1800	17	22	25	28	30	32	35	38
1700	18	24	26	30	32	34	37	40
1600	18	25	28	32	34	36	40	43
1500	19	27	30	34	36	39	42	45
1400	21	29	32	36	39	42	45	49
1300	22	31	34	39	42	45	49	53
1200	23	34	37	42	45	49	53	57
1100	25	37	41	46	50	53	58	62
1000	26	40	45	51	55	59	64	68
0900	28	43	50	56	61	65	71	76
0800	31	46	56	64	68	73	80	85
0700	33	50	63	73	78	85	85	85
0600	36	55	70	85	85	85	85	85
0500	39	61	79	85	85	85	85	85
0400	43	67	85	85	85	85	85	85
0300	48	80	85	85	85	85	85	85
0200	55	85	85	85	85	85	85	85
0100	71	85	85	85	85	85	85	85

Table 7.2 (1psi = 0.06894757bar)

Notes

1. For intermediate operating pressure, the D/t ratio may be interpolated.
2. D/t ratio means the OD divided by the nominal wall thickness.
3. Design conditions are the following:
   (i) 6 ft (2.0 m) minimum depth of cover;
   (ii) 130 ˚F (55 C) temperature differential;
   (iii) maximum hoop stress of 50% SYMS;
   (iv) maximum combined circumferential stress of 72% SYMS;
   (v) maximum combined equivalent tensile stress of 90% SYMS;
   (vi) E80 rail loading criteria with an impact factor of 1.4 at the surface, reducing linearly to 1.0 at 10 ft (3.0 m);
   (vii) fluctuating stress limitation of 10 Psi (69 Pa) based upon 2,000,000 cycle's and;
   (viii) maximum D/t ratio of 85.

7.19 APPROVAL FOR CROSSINGS

Prior to the construction of a pipeline crossing, arrangement should be made with the pertinent authority in charge of the facility to be crossed.

7.20 RAILROAD AND HIGHWAY CROSSINGS

(a) The safety of the general public and the prevention of damage to the pipeline by reason of its location are primary considerations. The great variety of such crossings precludes standard design. The construction specifications shall cover the procedure for such crossings, based upon the requirements of the specific location.

(b) Installation of uncased carrier pipe is preferred. Installation of carrier pipe, or casing if used, shall be in accordance with API RP 1102. If casing is used, coated carrier pipe shall be independently supported outside each end of the casing and insulated from the casing throughout the cased section, and casing ends shall be sealed using a durable, electrically nonconductive material.

(c) The sum of circumferential stresses due to internal design pressure and external load in pipe installed under railroads and highways without use of casing shall not exceed the allowable stresses.

7.21 IMPACT FACTOR

As carrier pipe at an uncased crossing will be subjected to both internal load from pressurization and external load from earth forces (dead load) and train or highway traffic live load) an impact factor should be applied to the live load in accordance with API RP 1102.

7.22 CASING VENTS

If casing vents are provided they shall extend 2 ft from ground and shall be minimum NPS 2", one at each end of the casing. Vent pipes shall terminate with goosenecks, facing down. The vent pipe at the lower end of the casing shall be connected to the bottom of the casing, while the vent pipe at the higher end of the casing shall be connected to the top of the casing.

7.23 INSPECTION AND TESTING

Before installation, the section of carrier pipe used at the crossing should be inspected visually for defects. All girth welds should be inspected by radiographic or other nondestructive methods. After a cased crossing is installed, a test should be performed to determine that the carrier pipe is electrically isolated from the casing pipe.

7.24 CATHODIC PROTECTION

Cathodic protection systems at cased crossing should be reviewed carefully. Casing may reduce or eliminate the effectiveness of cathodic protection. The introduction of a casing creates more complicated electrical system than would prevail for uncased crossings, so there may be difficulties in securing and interpreting cathodic protection measurement at cased crossing. Test stations with test leads attached to the carrier pipe and casing pipe should be provided at each cased crossing. (Ref API RP 1102-93)

7.25 LINE MARKERS

(a) Line marker must be placed and maintained as close as practical over each buried line.

(b) At each crossing of a public highway, road and railroad.

(c) Wherever necessary to identify the location of the oil line to reduce the possibility of damage or interference.

(d) At every turning point and at fence crossings.

(e) Line marker must be placed and maintained along each section of the line that is located above ground in an area accessible to the public.

(f) Line marker must be placed and maintained along each section of the line that is located above ground in an area accessible to the public.

(g) Line marker must be placed and maintained at every ½ k.m (approximately).

(h) Line markers must be placed and maintained at any other location where it is necessary as a warning for public safety.

(i) The following must be written legibly on a background of sharply contrasting color on each line marker:

(i) the word “Warning”, “Caution” or “Danger” followed by the “Oil” (or name of oil transported), “pipeline” all of which except for markers in heavily developed urban areas must be in letters at-least 1 inch (25 mm) high ¼ inch (6.4 mm) stroke;

(ii) the name of the company and the help number (including area code) where the company can be reached at all time;

(iii) line markers are not required in location classes 3 and 4, where placement of a line marker would be impractical.

(iv) Line marker design should be such that it cannot cause damage to personnel by keeping all safety aspects in view (round corners or rounded shape)

(j) API RP 1109 shall be used for guidance.

7.26 PUMP STATION, TANK FARM AND TERMINAL CONSTRUCTION

All construction work performed on pump stations, tank farms, terminals equipment installations, piping, and allied facilities shall be done under construction specifications. Such specification shall cover all phases of the work under contract and shall be in sufficient detail to insure that the requirements of this code shall be met. Such specification shall include specific details on soil conditions, foundation

and concrete work, steel fabrication and building erection, piping, welding, equipment and materials and all construction factors contributing to safety and sound engineering practice.

Sufficient open space shall be left around the building and manifolds to provide access for maintenance equipment and fire fighting equipment. The station, tank farm or terminal shall be fenced in such a manner as to minimize trespass, and roadways and gates should be located to give ready access to or egress from the facilities.

7.27 STORAGE AND WORKING TANKAGE

All construction work performed on storage and working tankage and allied equipment, piping, and facilities shall be done under construction specifications. Such specifications shall cover all phases of the work under contract, and shall be in sufficient detail to insure that the requirements of this document shall be met. Such specifications shall include specific details on soil conditions, foundations and concrete work, tank fabrication and erection, piping, welding, equipment and materials, dikes, and all construction factors contributing to safety and sound engineering

7.28 LIQUID STRAINERS AND FILTERS

Strainers and filters shall be designed to the same pressure limitations and subjected to the same test pressure as the piping system in which they are installed, and supported in such a manner as to prevent undue loading to the connecting piping system. Installation and design shall provide for ease of maintenance and servicing without interference with the station operation. The filtering medium should be of such retention size and capacity as to fully protect the facilities against the intrusion of harmful foreign substances.

7.29 PUMPING EQUIPMENT AND PRIME MOVERS

Installation of pumping equipment and prime movers shall be covered by detailed plans and specifications which have taken into account the variables inherent in local soil conditions, utilization, and arrangement of the equipment to provide the optimum in operating ease and maintenance access. Machinery shall be handled and mounted in accordance with recognized good millwright practice and be provided with such protective covers as to prevent damage during construction. Recommendations of installation details provided by manufacturers for auxiliary piping, setting, and aligning shall be considered as minimum requirements.

7.30 PUMP STATION, TANK FARM AND TERMINAL PIPING

All piping, including but not limited to main unit interconnections, manifolds, scraper traps, etc., which can be subject to the mainline pressure shall be constructed in accordance with the welding standards (Regulation 8), corrosion control requirements (Regulation 12) and other practices of this code.

7.31 CONTROLS AND PROTECTIVE EQUIPMENT

Pressure controls and protective equipment, including pressure limiting devices, regulators, controllers, relief valves, and other safety devices, as shown on the drawings or required by the specifications, shall be installed by competent and skilled workmen. Installation shall be accomplished with careful handling and minimum exposure of instruments and devices to inclement weather conditions, dust, or dirt to prevent damage. Also, piping, conduits or mounting brackets shall not cause the instruments or devices to be distorted or in any strain. Instruments and devices shall be installed so that they can be checked without interruptions in operations. After installation, controls and protective equipment shall be tested under conditions approximating actual operations to assure their proper functioning.

7.32 FIRE PROTECTION

Fire protection when provided shall be in accordance with recommendations in NFPA 30. If the system installed requires the services of fire pumps, their motive power shall be separate from the station power so that their operation shall not be affected by emergency shutdown facilities.

7.33 ELECTRICAL INSTALLATIONS

Electrical installations for lighting, power and control shall be covered by detailed plans and specifications, and installations shall be in accordance with codes applicable to the specific type of circuitry and classification of areas for electrical installation. Inspection shall be provided and all circuitry shall be tested before operation to assure that the installation was made in workmanlike manner to provide for the continuing safety of personnel and equipment. Installations shall be made in accordance with ANSI/NFPA 70 and API RP 500 C.

7.34 LIQUID METERING

Positive displacement meters, turbine meters, or equivalent liquid measuring devices and their proving facilities shall be designed and installed in accordance with API Manual of Petroleum Measurement Standards.

Provisions shall be made to permit access to these facilities by authorized personnel only. Assembly of the metering facility components shall be in accordance with Regulation 7.30

7.35 ASSEMBLY OF PIPING COMPONENTS

The assembly of the various piping components, whether done in a shop or as a field erection, shall be done so that the completely erected piping conforms with the requirements of this code and with the specific requirements of the engineering design.

7.36 PUMPING UNIT PIPING

Piping to main pumping units shall be so designed and supported that when assembled to the pump flanges and valves it should be relatively free of stress and should not add stress or load to the pump frame.

The design and assembly shall take into account the forces of expansion and contraction to minimize their effect within the assembly. All valves and fittings on pumping units shall carry the same pressure ratings as required for line operating pressures.

Welding shall be in accordance with Regulation 8 of the code.

7.37 DIKES OR FIREWALLS

The protection of the pipeline's station, tank farm, terminal or other facilities from damage by fire from adjacent facilities as well as the protection of the general public may dictate the need of dikes or firewalls around tankage or between tankage and station or terminal. Tank dikes or firewalls, where required, shall be constructed to meet the capacity requirement set out in the relevant technical standards notified by OGRA, if any, or otherwise relevant API/NFPA codes be followed.

8. WELDING

8.1 GENERAL

Welding herein applies to the arc and gas welding of pipe in both wrought and cast steel materials as applied in pipelines and connections to apparatus or equipment. Cutting and welding shall begin only when safe conditions are indicated.

8.2 EQUIPMENT

Welding equipment shall be of a size and type suitable for the works, and it shall be maintained in a condition that ensures acceptable welds, continuity of operation and safety of personnel. Arc welding equipment shall be operated within the amperage and voltage ranges given in qualified welding procedures.

8.3 MATERIAL

This applies to the welding of pipe and fittings that conform to the following specification:

(i) API specification 5L

(ii) Applicable ASTM specification

8.4 FILLER METAL

All filler metal shall conform to one of the following specification:

- AWS A 5.1
- AWS A 5.2

- AWS A 5.5
- AWS A 5.17
- AWS A 5.18
- AWS A 5.20
- AWS A 5.28
- AWS A 5.29

8.5 PROCEDURE QUALIFICATION

Before production welding is started, a detailed procedure specification shall be established and qualified to demonstrate that welds with suitable mechanical properties and soundness can be made by the procedures. Welding procedures and each welder or welding operator shall be qualified under API 1104, or Section IX of the ASME Boiler and Pressure Vessel Code, whichever is appropriate for the type of welding to be performed.

8.6 PROCEDURE SPECIFICATION

The procedure specification shall include the following information:

a). Process:

The specific process or combination of process used shall be identified. The use of manual, semiautomatic or automatic welding process or any combination of these shall be specified.

b). Pipe and Fitting Materials:

The material to which the procedures apply shall be identified.

c). Diameter and Wall Thickness:

The ranges of diameters and wall thickness over which the procedure is applicable shall be identified.

d). Joint Design:

The specification shall include a sketch or sketches of the joint that show the angle of bevel the size of the root face, and the root opening or the space between abutting members. The shape and size of fillet welds shall be shown. If a backup is used, the type shall be designated.

e). Filler Metal and Number Beads:

The sizes and classification number of the filler metal and the minimum number and sequence of beads shall be designated.

f). Electrical Characteristics:

The current and polarity shall be designated and the range of voltage and amperage for each electrode, rod, or wire shall be shown.

g). Position:

The specification shall designate roll or position welding.

h). Direction of Welding:

The specification shall designate whether the welding is to be performed in an uphill or downhill direction.

i). Time between Passes:

The maximum time between the completion of the root bead and the start of the second bead as well as the maximum times between the completion of the second bead and the start of other beads, shall be designated.

j). Type and Removal of Lineup Clamp:

The specification shall designate whether the lineup clamp is to be internal or external or if no clamp is required. If a clamp is used, the minimum % of root-bead welding that must be completed before the clamp is released shall be specified.

k). Cleaning and/or Grinding:

The specification shall indicate whether power tools or hand tools are to be used for cleaning, grinding or both.

l). Pre- and Post- Heat Treatment:

The methods, temperature, temperature control method, and ambient temperature range for pre- and post- heat treatment shall be specified.

m). Speed Of Travel:

The range for speed of travel, in inches (millimeters) per minute, shall be specified for each pass.

8.7 ESSENTIAL VARIABLES

A welding procedure must be re-established as a new procedure specification and it must be completely pre-qualified when any of the essential variable listed below are changed.

a). Welding Process

A change from the welding process or method of application established in the procedure specification constitutes an essential variable.

b). Base Material

A change in base material constitutes an essential variable. For this purpose the standard of all material, shall be grouped as follows:

(a) specified minimum yield strength less than or equal to 42,000 Psi (290 MPa);

(b) specified minimum yield strength greater than 65,000 Psi (448 MPa);

(c) for material with specified minimum yield strength greater than or equal to 65,000 Psi (448 MPa), each grade shall receive a separate qualification test.

c). Joint Design

A major change in joint design (for e.g. from V groove to U groove) constitutes an essential variable, minor changes in the angle of bevel or the land of this welding groove are not essential variables.

d). Position

A change in position from roll to fix or vice versa constitutes an essential variable.

e). Wall Thickness

A change from wall thickness group to another wall thickness group constitutes essential variables as mentioned under qualification of welders.

f). Filler material

A change in filler metal constitutes essential variables.

g). Electrical characteristic

A change from DC electrode positive to DC electrode negative or vice versa or a change in current from DC to AC or vice versa constitutes an essential variable.

h). Time Between Passes

An increase in the maximum time between completion of the root bead and the start of the second bead constitutes an essential variable.

i). Direction of Welding

A change in the direction of welding from vertical down hill to vertical up hill or vice versa constitutes an essential variable.

j). Speed of Travel

A change in the range for speed of travel constitutes an essential variable.

8.8 QUALIFICATION OF WELDERS

The purpose of the welder's qualification test is to determine the ability of welders to make sound butt or fillet welds using previously qualified procedures. Before any production welding is performed, welders shall be qualified according to the applicable requirement.

A welder who has successfully completed the qualification test described in API 1104 shall be qualified within the limit of the essential variable, described below. If any of the following essential variables are changed, the welder using the new procedure shall be re-qualified:

(a) A change from one welding process to another welding process or combination of processes.

(b) A change in the direction of welding from vertical uphill to vertical downhill or vice versa.

(c) A change of filler metal classification.

(d) A change from one outside diameter group to another. These groups are defined as follows:

(i) outside diameter less than 2-3/8inches (60.3 mm);
(ii) out-side diameter from 2-3/8 inches (60.3 mm) through 12-3/4 inches (323.8 mm);

(iii) outside diameter greater than 12¾ inches (323.8 mm).

(e) A change from one wall thickness group to another. These groups are defined as follows:

(i) nominal pipe wall thickness less than 3/16 inch (4.8 mm);

(ii) nominal pipe wall thickness from 3/16 inch (4.8 mm) through ¾ inch (19 mm);

(iii) nominal pipe wall thickness greater than ¾ inch (19 mm).

(f) A change in position from that for which the welder has already qualified (for example, change from rolled to fixed or a change from vertical to horizontal or

vice versa). A welder who successfully passes a butt-weld qualification test in the fixed position with the axis inclined 45 degree from the horizontal plane shall be qualified to make the butt-welds in all positions.

(g) A change in the joint design for example the use of a backing, strip or a change from V bevel to U bevel.

8.9 PREPARATION OF A JOINT FOR PRODUCTION WELDING

Piping shall be welded by qualified welders using qualified procedures. The surface to be welded shall be smooth, uniform and free from lamination, tears, slag, grease, paint, and other deleterious material that might adversely affect the welding.

a). Alignment:

The alignment of the abutting ends shall minimize the offset between surfaces. For pipe ends of the same nominal wall thickness, the offset shall not exceed 1/8 inch (3 mm). Larger variations are permissible if a larger offset is caused by dimensional variations and it is equally distributed around the circumference of the pipe. Hammering of the pipe to obtain proper line up should be kept to a minimum.

b). Use of Lineup Clamp for Butt Welds

Lineup clamps shall be used for butt welds in accordance with the procedure specification. When it is permissible to remove the clamp before the root bead is completed, the completed part of the bead shall be in approximately equal segments spaced equally around the circumference of the joint. However, when an internal lineup clamp is used and conditions make it difficult to prevent movement of the pipe or if the weld will be unduly stressed the root bead shall be completed before clamp tension is released. Root bead segments used in connection with external clamps shall be uniformly spaced around the circumference of the pipe and shall have an aggregate length of at least 50% of the pipe circumference before the clamp is removed.

c). Mill Bevel

All mill bevels on pipe ends shall conform to the joint design used in the procedure specification.

d). Field Bevel

Pipe ends should be field beveled by machine tool or machine oxygen cutting. If necessary, manual oxygen cutting may also be used. The beveled ends shall be reasonably smooth and uniform and dimensions shall be in accordance with the procedure specification.

e). Weather Conditions

Welding shall not be done when the quality of the completed weld would be impaired by the prevailing weather conditions, including but not limited to airborne moisture, blowing sands, or high winds. Windshields shall be used when practical.

f). Clearance

When the pipe is welded above ground, this working clearance around the pipe at the weld should not be less than 16 inches (406.4 mm). When the pipe is welded in a trench, the bell hole shall be large enough to provide the welder or welders with ready access to the joint.

g). Cleaning Between Beads

Scale and slag shall be removed from each bead and groove. Power tools shall be used when called for in the procedure specification, otherwise, cleaning may be done by hand or by power tools. When automatic or semiautomatic welding is used, surface porosity clusters, bead starts and high points shall be removed by grinding before weld metal is deposited over them.

h). Position Welding

All position welds shall be made with the parts to be joined secured against movement and with adequate clearance around the joint to allow the welder, or welders space to work.

i). Filler and Finish Beads

For position welding, the number of filler and finish beads shall be such that the completed weld attains a substantially uniform cross section around the entire circumference of the pipe. At no point shall crown surface be below the out side surface of the pipe, nor should it be raised above the parent metal by more than 1/16 inch (1.6 mm). Two beads shall not be started at the same location. The face of the completed weld should be approximately 1/8 inch (3.2 mm) wider than the width of the original groove. The completed weld shall be thoroughly brushed and cleaned.

j). Identification of Welds

Each welder shall identify his work in the manner prescribed by the procedure.

k). Pre- and Post Heat Treatment

The procedure specification shall specify the pre and post heat treatment practices that are to be followed when materials or weather conditions make either or both treatment necessary.

8.10 INSPECTION AND TESTING OF PRODUCTION WELDS

(a) Visual inspection welding must be conducted to ensure that:

(i) the welding is performed in accordance with the welding procedure;
(ii) the weld is acceptable under Section 6 of API Standard 1104.

(b) The welds on a pipeline to be operated at a pressure that produces a hoop stress of 20% or more of SMYS must be non-destructively tested on a percentage basis as given below under non-destructive testing.

8.11 ACCEPTANCE STANDARDS FOR NONDESTRUCTIVE TESTING

The acceptability of discontinuities located by radiographic, magnetic particle, liquid penetrant and ultrasonic test method is determined according to Section 9 of API Standard 1104.

9. INSPECTION

9.1 GENERAL

Construction inspection provisions for pipelines and related facilities shall be adequate to assure compliance with the material, construction, welding, assembly and testing requirement of this code.

9.2 QUALIFICATION OF INSPECTORS

Inspection personnel shall be qualified by training and experience. Such person shall be capable of performing the following inspection services:

(a) Right of way and grading.

(b) Ditching.

(c) Line up and pipe surface inspection.

(d) Welding.

(e) Coating.

(f) Tie-in and lowering.

(g) Backfilling and clean up.

(h) Pressure testing.

(i) Special services for testing and inspection of facilities; such as station construction, river crossing, electrical installation, radiography, corrosion control etc as may be required.

9.3 TYPE AND EXTENT OF EXAMINATION REQUIRED

9.3.1 Visual

(a) Material

(i) all piping components shall be visually inspected to insure that no mechanical damage has occurred during shipment and handling prior to being connected into the piping system;

(ii) all pipes shall be visually inspected to discover any defects;

(iii) On system where pipe is telescoped by grade, wall thickness or both, particular care shall be taken to insure proper placement of pipe. Permanent records shall be kept showing the location as installed of each grade, wall thickness, type, specification and manufacturer of the pipe.

(b) Construction

(i) Visual inspection for detection of surface defects in the pipe shall be provided for each job just ahead of any coating operation and during the lowering in and backfill operation.

(ii) The pipe swabbing operation shall be inspected for thoroughness to provide a clean surface inside the pipe.

(iii) Before welding, the pipe shall be examined for damage-free bevels and proper alignment of the joint.

(iv) The stringer bead shall be inspected, particularly for cracks before subsequent beads are applied.

(v) The completed weld shall be cleaned and inspected prior to coating operations, and irregularities that could protrude through the pipe coating shall be removed.

(vi) When the pipe is coated, inspection shall be made to determine that the coating machine does not cause harmful gouges or groove in the pipe surface.

(vii) Laceration of the pipe coating shall be inspected prior to repair of coating to see if the pipe surface has been damaged. Damaged coating and pipe shall be repaired before the pipe is lowered in the ditch.

(viii) All repair, change or replacement, shall be inspected before they are covered up.

(ix) The condition of the ditch shall be inspected before the pipe is lowered in to assure proper protection of pipe and coating. For under water crossing, and offshore pipeline, the condition of the ditch and fit of the pipe to the ditch shall be inspected when feasible.

(x) The fit of the pipe to ditch shall be inspected before the back filling operations.

(xi) Except for offshore pipelines, the backfilling operations shall be inspected for quality and compaction of backfill, placement of material for the control of erosion, and possible damage to the pipe coatings. For offshore pipelines the backfill shall be inspected when feasible.

(xii) Cased crossing shall be inspected during installations determine that the carrier pipe is supported, sealed and insulated from the casing.

(xiii) River crossings shall have thorough inspection and shall be surveyed and profiled after construction.

(xiv) All piping components other than pipe shall be inspected to insure damage free condition and proper installation.

10. TESTING

10.1 GENERAL

(a) It is necessary that tests be made upon the completed system and upon component parts of the finished system.

(b) Should leaks occur on tests, the line section or component part shall be repaired or replaced and retested in accordance to this code.

10.2 TEST MEDIUM

The hydrostatic test should be conducted with water.

10.3 EQUIPMENT FOR A HYDROSTATIC TEST

Equipment for the hydrostatic test should suit the conditions and be in good working order.

10.4 TEST PLAN AND PROCEDURE

A hydrostatic test plan and procedure diagram with explanatory notes and data should be prepared prior to testing, and it includes the following details:

(i) the length and location of the test segment;

(ii) test medium to be used;

(iii) procedures for cleaning and filling the line;

(iv) procedures for the pressurization of the test including the location of the injection points and the specified minimum and maximum test pressure;

(v) minimum test duration for test segment;

(vi) procedures for and disposal of test medium;

(vii) safety precautions and procedures.

A specified test pressure is defined as the minimum test pressure which should be applied to the most elevated point in the test segment detail analysis of the profile to determine static and dynamic pressures while the pipeline is being tested should be performed so that the pipeline will not be overpressured at points which are at low elevations.

10.5 HYDROSTATIC TESTING OF INTERNAL PRESSURE PIPING

Portions of piping systems to be operated at a hoop stress of more than 20% of the specified minimum yield strength of the pipe shall be subjected at any point to a hydrostatic proof test equivalent to not less than 1.25 times the internal design pressure at that point for not less than 4 hrs.

10.6 LEAK TESTING

A 1 hr hydrostatic or pneumatic leak test may be used for piping systems to be operated at a hoop stress of 20% or less of the specified minimum yield strength of the pipe. The hydrostatic test pressure shall be not less than 1.25 times the internal design pressure.

10.7 PRESSURIZATION

Personal conducting the test should maintain continuous surveillance over the operation and ensure that it is carefully controlled. The test segment should be pressurized at a moderate and constant rate, when approximately 70% of the specified test pressure is reached, the pumping rate should be regulated to minimize pressure variation and to ensure that increments of no greater than 100 KPa (14.5 psi) may be accurately read and recorded. A pressure recording gauge should be installed in parallel with a dead weight tester, and it should be checked at regular intervals throughout the testing period by the deadweight tester. The bourdon tube type pressure gauge is used only for approximation of pressure and its readings need to be recorded. Pipe connection should be periodically checked for leaks during pressurization.

(Ref: API RP 1110)

10.8 HYDROSTATIC TEST RECORD

Each company shall record testing information, and will retain it for the useful life of the pipeline; the record must contain at least the following information:

(i) the name of the company and the employee responsible for making the test and the name of any testing company used;

(ii) test medium used;

(iii) test pressure;

(iv) test duration;

(v) pressure recording charts or other record of pressure readings;

(vi) elevation variations, whenever significant for the particular test;

(vii) leaks and failure, noted and their disposition;

(viii) ambient and ground temperatures at start and end of test.

(ix) Design/ recommended test pressure max/min limits

10.9 DISPLACEMENT OF TEST MEDIUM

Water should be displaced with splits, squeegees and/or other pigging devices. Water should be disposed-off at approved locations in a manner that will cause minimal environment effects.

10.10 RECORDS

A record shall be maintained in the files of the operating company related to design, construction, and testing of each mainline within the scope of this code. These records shall include material specification, route maps and alignments sheets for “as-built” conditions; location of each pipe size, grade, wall thickness, type of seam (if any), and manufacturer, coating, test data. These records shall be kept for the life of the facility.

11. OPERATION AND MAINTENANCE PROCEDURES

11.1 GENERAL

Each operating company shall develop operating and maintenance procedures based on the provisions of this code, and the company’s experience and knowledge of its facilities and condition under which they are operated, which will be adequate from the standpoint of public safety.

The methods and procedures set forth herein serve as a general guide, but do not relieve the individual or operating company from the responsibility for prudent action that current particular circumstances make advisable.

It must be recognized that the local conditions such as the effect of temperature, characteristics of the line contents and topography will have considerable bearing on the approach to any particular maintained and repair job. Suitable safety equipment shall be available for personnel use at all work areas and operating facilities.

11.2 OPERATION AND MAINTENANCE PLANS AND PROCEDURE:

Each operating company having a transportation piping system within the scope of this code shall:

(a) have written detailed plans and training programs for employees covering operating and maintenance procedures for the transportation piping system during normal operation and maintenance in accordance with the purpose of the codes;

(b) have a plan for external and internal corrosion control of new and existing piping system, including requirement and procedures prescribe in above para;

(c) have a written emergency plan for implementation in the event of system failure, accidents or other emergencies train appropriate operating and maintenance employees with regard to applicable portion of the plan, and establish liaison with appropriate public official with respect to the plan;

(d) have a plan for reviewing changes in conditions affecting the integrity and safety of the piping system, including provision, for periodic patrolling and reporting of construction activity and change in condition, especially in industrial, commercial and residential areas and at river, railroad, and highway crossings in order to consider the possibility of providing additional protection to prevent damage to the pipeline;

(e) establish liaison with local authorities who issue construction permits in urban areas to prevent accidents caused by excavators;

(f) establish procedure to analyze all failures and accidents for the purpose of determining the cause and to minimize the possibility of recurrence;

(g) maintain necessary maps and records to properly administer the plans and procedures;

(h) have procedures for abandoning piping systems;

(i) in establishing plan and procedures, give particular attention to those portions of the system presenting the greatest hazard to the public in the event of

emergencies or because of contribution or extraordinary maintenance requirements;

(j) operate and maintain its piping system in conformance with these plans and procedures;

(k) modify the plans and procedures, from time to time as experience dictates and as exposure of the system to the public and changes in operating conditions require.

11.3 PIPELINE OPERATION AND MAINTENANCE

11.3.1 Operating Pressure

(a) Care shall be exercised to assure that at any point in the piping system the maximum steady state operating pressure and static head pressure with the line in a static condition do not exceed at that point the internal design pressure and pressure rating for the component used. The level of pressure rise due to oil and other variations from normal operation does not exceed the internal design pressure at any point in the piping system and equipment by more than 10%;

(b) A piping system shall be qualified for a higher operating pressure when the higher operating pressure will produce a hoop stress of more than 20% of the specified minimum yield strength of the pipe, as per the requirements of the relevant codes.

(c) If a piping system is derated to lower operating pressure in lieu of repair or replacement, the new maximum steady state operating pressure shall be determined;

(d) For existing systems utilizing material, produced under displacement of super sided standards or specifications, the internal design pressure shall be determined using the allowable stress and design criteria listed in the issue of the applicable code or specification effect at the time of the original construction.

11.4 COMMUNICATIONS

A communications facility shall be maintained to assure safe pipeline operations under both normal and emergency conditions.

11.5 MARKERS

(a) Markers shall be installed over each line on each side of road highway, railroad and stream crossing to properly locate and identify the system. Markers are not required for pipelines offshore.

(b) Pipeline markers at crossing, aerial markers when used and other sign shall be maintained so or to indicate the location of the line. These markers shall show the name of the operating company and where possible an emergency telephone contact. Additional pipeline markers shall be installed along the line in areas of development and growth to protect the system from encroachment. API RP 1109 shall be used for guidance.

(c) Markers shall also be installed at every turning point and at fence crossings.

11.6 RIGHT OF WAY MAINTENANCE

(a) The right of way should be maintained so as to have clear visibility and to give reasonable access to maintenance crews.

(b) Access shall be maintained to valve locations.

(c) Diversion ditches or dikes shall be maintained where needed to protect against washouts of the line and erosion of landowner's property.

11.7 PATROLLING

(a) Each operating company shall maintain a pipeline patrol program to observe surface conditions on and adjacent to the pipeline right of way, indication of leaks, construction activity other than that performed by the company and any other factors affecting the safety and operation of the pipeline. Special attention shall be given to such activities as road building, ditch cleanout, excavations and like encroachments to the pipeline system.

(b) Patrols shall be made at intervals not exceeding 2 weeks.

11.8 PIPELINE REPAIRS

(a) Repairs shall be covered by a maintenance plan and shall be performed under qualified supervision by trained personnel aware of and familiar with the hazards to public safety, utilizing strategically located equipment and repair materials. The maintenance plan shall consider the appropriate information contained in API PUBL 2200, API PUBL 2201, API RP 1107, and API RP 1111;

(b) Piping in the vicinity of any repair shall be adequately supported during and after the repair.

(c) Scaffolding where necessary should be according to the standard & safe working practices.

11.9 DISPOSITION OF DEFECTS

Limits and dispositions of imperfections:

(a) Gouges and grooves having a depth greater than 12.5% of the nominal wall thickness shall be removed or repaired.

(b) Dents meeting any of the following conditions shall be removed or repaired:
   (i) dents which affect the pipe curvature at the pipe seam or at any girth weld;
   (ii) dents containing a scratch, gauge, or groove, or;
   (iii) dents exceeding a depth of 0.25 inch (6 mm) in pipe NPS 4 and smaller or 6% of the nominal pipe diameter in sizes greater than NPS 4.

(c) All arc burns shall be removed or repaired.

(d) All cracks shall be removed or repaired.

(e) All welds found to have defect, as set forth in or in the appropriate pipe specification shall be removed or repaired.

11.10 GENERAL CORROSION

(a) Pipe shall be replaced or repaired if the area is small or operated at a reduced pressure, if the general corrosion has reduced the wall thickness to less than the design thickness calculated, decreased by an amount equal to the manufacturer tolerance applicable to the pipe or component.

(b) Areas where grinding has reduced the remaining wall thickness to less than the design thickness, decrease by an amount equal to the manufacturing tolerance applicable to the pipe or component, may be analyzed the same as localized corrosion pitting to determine if ground areas need to be repaired, replaced or the operating pressure reduced.

(c) All pipe containing leaks shall be removed or repaired.

11.11 VALVE MAINTENANCE

Pipeline block valve shall be inspected, serviced where necessary and practically operated at least once each year to assure proper operating conditions.

11.12 RAILROADS AND HIGHWAYS CROSSING EXISTING PIPELINE

(a) When an existing pipeline is to be crossed by a new road or railroad, the operating company shall analyze the pipeline in the area to be crossed in terms of the new anticipated external loads. If the sum of the circumferential stresses caused by internal pressure and newly imposed external loads exceeds 0.72 SMYS (Specified Minimum Yield Strength) by more than 25%, the operating company shall install mechanical reinforcement, structural protection or suitable pipe to reduce the stress or redistribute the external loads acting on the pipeline. API RP 1102 provides methods which may be used to determine the total stress caused by internal pressure and external loads.

(b) Installation of uncased carrier pipe is preferred. Adjustment of existing pipeline in service at a proposed railroad or highway crossing shall conform to detail contained in API RP 1102. If casing is used, coated carrier pipe shall be independently supported outside each end of the casing and insulated from the casing throughout the cased section and casing ends shall be sealed using a durable, electrically non-conductive material.

(c) Testing and inspection of replaced pipe sections shall conform to requirements of this code. All new girth welds in the carrier pipe shall be radio-graphed or inspected by other acceptable nondestructive methods (Visual inspection excepted).

11.13 PLATFORM RISERS

Riser installation shall be visually inspected annually for physical damage and corrosion in the splash zone and above. The extent of any observed damage shall be determined and if necessary, these riser installation shall be repaired or replaced.

11.14 PUMP STATION, TERMINAL AND TANK FARM OPERATION AND MAINTENANCE

(a) Starting, operating and shutdown procedures for all equipment shall be established and the operating company shall take appropriate step to see that these procedures are followed. These procedures shall outline preventive measures and systems checks required to ensure the proper functioning of all shutdown, control and alarm equipment.

(b) Periodic measurement and monitoring of flow and recording of discharge pressures shall be provided for detection of deviations from the steady state operating conditions of the system.

11.15 CONTROL AND PROTECTIVE EQUIPMENT

Control and protective equipment, including pressure limiting device, regulator, controllers, relief valves and other safety device, shall be subjected to systematic periodic inspections and test, at least annually, to determine that they are:

(i) in good mechanical condition;

(ii) adequate from the standpoint of capacity and reliability of operation for the service in which they are employed;

(iii) set to function at the correct pressure;

(iv) properly installed and protected from foreign material or other conditions that might prevent proper operation.

11.16 STORAGE VESSELS

(a) Storage vessels, including atmospheric and pressure tanks handling the liquid or liquids being transported shall be periodically inspected and pertinent records maintained. Points to be covered include:
   (i) stability of foundation;
   (ii) condition of bottom, shell, stairs and roof;
   (iii) venting or safety valve equipment;
   (iv) condition of firewall, or tank dikes.

(b) Storage vessels and tanks shall be cleaned in accordance with API PUBL 2015.

11.17 STORAGE OF COMBUSTIBLE MATERIALS

All flammable or combustible materials in quantities beyond those required for every day use or other than those normally used in pump houses shall be stored in a separate structure built on non combustible material located a suitable distance from the pump house. All aboveground oil or gasoline storage tanks shall be protected in accordance with the relevant technical standards notified by OGRA, if any, or otherwise with NFPA 30.

11.18 FENCING

Station, terminal and tank farm areas shall be maintained in a safe condition, and shall be fenced and locked or attended for the protection of the property and the public.

11.19 SIGNS

(a) Suitable signs shall be pasted to serve as warnings in hazardous areas.

(b) Classified and high voltage areas shall be adequately marked and isolated.

(c) Caution signs shall be displayed indicating name of the operating company and where possible, and emergency telephone contact.

11.20 PREVENTION OF ACCIDENTAL IGNITION

(a) Smoking shall be prohibited in all areas of a pump station, terminal, or tank farm in which the possible leakage or presence of vapor constitute a hazard of fire or explosion.

(b) Flashlights or hand lanterns, when used, shall be of the approved flame/ explosion proof type as per hazardous area classification of the facility.

(c) Cutting and welding shall begin only when safe conditions are indicated.

(d) Consideration should be given to the prevention of other means of accidental ignition.

11.21 CORROSION CONTROL

Protection of ferrous pipe and components from external and internal corrosion, including tests, inspections and appropriate corrective measures, shall be as prescribed in Regulation 12 (Corrosion Control).

11.22 EMERGENCY PLAN

(i) A written emergency plan (displayed at necessary location) shall be established for implementation in the event of system failure, accidents, or other emergencies and shall include procedures for prompt and expedient remedial action providing for the safety of the public and operating company personnel, minimizing property damage, protecting the environment, and limiting accidental discharge from the piping system. These documents should be readily available.

(ii) The plan should provide for acquainting and training of personnel responsible for the prompt execution of emergency action. Personnel shall be informed covering the characteristic of the liquid in the piping system, and the safe practices in the handling of accidental discharge and repair of the facilities with emphasis on the special problems. The operating company shall establish scheduled services with personnel procedures to be followed in emergencies at intervals not exceeding six months, and services shall be conducted such that they establish the competence of the emergency plan.

(iii) Procedures shall cover liaison with state and local civil agencies such as fire departments, police department and highway patrol, to provide prompt inter communication for coordinated remedial action dissemination of information on location of system facilities, characteristics of the liquids transported, and joint preparation of cooperative actions necessary to assure the safety of the public in the event of emergencies.

(iv) A line of communication shall be established with residents along the piping system to recognize and report a system emergency to the appropriate operating company personnel. This could include supporting a card, sticker, or equivalent with names, addresses and telephone numbers of operating company personnel to be contacted.

(v) In the formulation of emergency procedures for limiting accidental discharge from the piping system, the operating company shall give consideration to:

a. formulating and placing in operation procedures for an area cooperative pipeline leak notification emergency action system between operating companies having piping system in the area;

b. reduction of pipeline pressure by ceasing pumping operation on the piping system, opening the system to delivery storage on either side of the leak site, and expeditious closing of block valves on both sides of the leak site;

c. interim instruction to local authorities prior to arrival of qualified operating company personnel at the leak site;

d. rapid transportation of qualified personnel to the leak site;

e. minimization of public exposure to injury and prevention of accidental ignition by evacuation of residents and the halting of traffic on roads, highways and railroads in the affected area.

11.23 RECORDS

For operation and maintenance purposes, the following records shall be properly maintained:

(a) necessary operational data;

(b) pipeline patrol records;

(c) corrosion records as required;

(d) leak and break record;

(e) record relating to routine or unusual inspection, such as external or internal line condition, when cutting line or hot tapping;

(f) pipeline repair records.

11.24 ABANDONING A PIPING SYSTEM

In the event of abandoning a piping system, it is required that:

(a) facilities to be abandoned in place shall be disconnected from all sources of the transported liquid, such as other pipelines, meter stations control lines and other appurtenances;

(b) facilities to be abandoned in place shall be purged of the transported liquid and vapor with an inert material and the ends sealed.

11.25 PUBLIC EDUCATION

Each company shall establish a continuing program to enable customers, the public, appropriate government organization and persons engaged in excavation related activities to recognize an oil pipeline emergency for the purpose of reporting it to the company or the appropriate public officials. The program must be conducted in English/Urdu and in other regional languages commonly understood by a significant number and concentration of the non-English acquainted population.

12. CORROSION CONTROL

12.1 GENERAL

This section prescribes minimum requirement and procedures for the protection of metallic pipelines and components from external, internal and atmospheric corrosion for new and existing piping system.

(a) External and internal corrosion shall be controlled in a manner consistent with the condition of the piping system and the environment in which the system is located.

(b) Each operating company shall establish procedures to implement its corrosion control program to achieve the desired objectives procedures, including those for design, installation, and maintenance of cathodic protection systems, shall be prepared and carried-out by, or under the direction of, persons qualified by training or experience in corrosion control methods.

(c) NACE RP-01-69 or NACE RP -06-75, may be referred for guidance.

(d) Corrosion personnel shall be provided equipment and instrumentation necessary to accomplish the work.

(e) Coating crews and inspectors shall be suitably instructed and provided with equipment necessary to coat and inspect the pipe and components.

12.2 EXTERNAL CORROSION CONTROL FOR BURIED OR SUBMERGED PIPELINES:

12.2.1 New Installations

(a) Control of external corrosion of new buried or submerged piping systems shall be provided for each component in the system except where the operating company can demonstrate by tests, investigation, or experience in the area of the application that a detrimental corrosion environment does not exist. However, within 12 months after installation, the operating company shall electrically inspect the buried or submerged system. If the electrical inspection indicates that a corrosion condition exists, the piping system shall be cathodically protected.

(b) Control of external corrosion of buried or submerged pipe of components in new installations (including new pump stations, tank farms, and terminals, and relocating, replacing, or otherwise changing existing piping systems) shall be accomplished by the application of an effective protective coating supplemented with cathodic protection and suitable drainage bonds in stray current areas. Materials shall be selected with due regard to the type of supplemental corrosion protection and to the environment.

12.2.2 Protective Coating

(a) Protective coating used on buried or submerged pipe and components shall have the following characteristics:
   (i) mitigate corrosion;
   (ii) have sufficient adhesion to the metal surface to effectively resist under film migration of moisture;
   (iii) be ductile enough to resist cracking;
   (iv) have strength sufficient to resist damage due to handling and soil stress;
   (v) have properties compatible with any supplemental cathodic protection.

(b) Welds shall be inspected for irregularities that could protrude though the pipe coating, and any such irregularities shall be removed.

(c) Pipe coating shall be inspected, both visually and by an electric holiday detector, just prior to lowering pipe into ditch. Holidays detected shall be repaired and reinspected.

(d) Insulating type coating, if used, shall have low absorption characteristics and provide high electric resistance.

(e) Pipe shall be handled and lowered into ditch or submerged so as to prevent damage after the electrical inspection. Pipe coating shall be protected from lowering – in damage in rough or detrimental environment by use of rock shield, ditch padding, or any other suitable protective measures.

(f) If coated pipe is installed by boring, driving precautions shall be taken to minimize damage to the coating during installation.

(g) The backfilling operation shall be inspected for quality, compaction, and placement of material to prevent damage to pipe coating.

(h) Where a connection is made to a coated pipe, all damaged coating shall be removed and new coating applied on the attachments as well on the pipe.

12.3 CATHODIC PROTECTION SYSTEM

The objective of using cathodic protections is to control the corrosion of metallic surface, in contact with electrolyte:

(a) A cathodic protection system provided by a galvanic anode or impressed current anode system shall be installed that will mitigate corrosion and contain a method of determining the degree of cathodic protection achieved on the buried or submerged piping system.

(b) A cathodic protection system shall preferably be installed at the same time as the construction but not later than one year after completion of construction.

(c) Cathodic protection shall be controlled so as not to damage the protective coating, pipe, or components.

(d) Owners of known underground structures that may be affected by installation of a cathodic protection system shall be notified of said installation, and where necessary parties involved shall conduct joint bonding surveys.

(e) Electrical installations shall be made in accordance with the U.S. National Electrical Code, ANSI/NFPA 70, API RP 500C.

(f) The cathodic protection system shall be compatible with coating used on the pipeline.

12.4 ELECTRICAL ISOLATION

(a) Each buried or submerged pipeline shall be electrically isolated from other underground metallic structure, unless the pipeline and the other structure are electrically interconnected and cathodically protected as a single unit.

(b) One or more insulating devices must be installed where electrical insulation of a portion of pipeline is necessary to facilitate the application of corrosion control.

(c) Inspection and electrical tests must be made to assure that electrical isolation is adequate.

(d) Where a pipeline is located in close proximity to electrical transmission tower footings ground cables, or counterpoise, or in other areas where fault currents or unusual risk of lightning may be anticipated. It must be provided with protection against damage due to fault currents or lightning and protection measures must also be taken at insulating devices.

(e) When a pipeline is separated, a bonding conductor of sufficient current carrying capacity shall be installed across the points of separation and retained during the period of separation.

12.5 TEST STATIONS

Each pipeline under cathodic protection required by this subpart must have sufficient test stations or other contact points for electrical measurement to determine the adequacy of cathodic protection.

12.6 TEST LEADS

(a) Each test lead wire must be connected to the pipeline so as to remain mechanically secure and electrically conductive.

(b) Each test lead wire must be attached to the pipeline in a manner that minimizes stress concentration on the pipe.

(c) Each base test lead wire and bore metallic arch at connection to the pipe line must be coated with an electrical insulating material compatible with the pipe coating and the insulation or wire.

12.7 ELECTRICAL INTERFERENCE

(a) Each company whose pipeline system is subjected to stray current shall have in effect a continuing program to minimize the detrimental effects of such currents;

(b) Each impressed current type cathodic protective system or galvanic anode system must be designed and installed so as to minimize any adverse effects in existing adjacent underground metallic structures;

12.8 EXISTING PIPING SYSTEM

The operating company shall establish procedures for determining the external condition of its existing buried or submerged piping system and take action appropriate for the conditions found, including but not limited to the following:

(a) examine and study record available from previous inspection and conduct additional inspections where the need for the additional information is indicated. The type, location number, and frequency of such factors as knowledge of the condition of the piping system environment and public or employee safety in the events of leakage shall be considered;

(b) install cathodic protection on all buried or submerged piping system that are submerged with an effective external surface coating material. All buried or submerged piping at compressor stations and terminal shall be electrically inspected and cathodic protection installed or augmented where necessary;

(c) operating pressure on bare piping system shall not be increased until they are electrically inspected and other appropriate actions are taken regarding condition of pipe and components.

12.8.1 Monitoring

(a) Each pipeline that is under cathodic protection must be tested at least once each calendar year but with intervals not exceeding 15 months, to determine whether the cathodic protection needs the requirements.

(b) Evidence of adequate level of cathodic protection shall be one or more of the criteria listed in criteria for cathodic protection, Section 6 in NACE RP-01-69, or Section 5 in NACE RP-06-75.

(c) Each company shall take prompt remedial action to correct any deficiencies indicated by monitoring.

(d) Each company shall, at interval, not exceeding 5 years, re-evaluate its unprotected pipelines and cathodically protect them in accordance with this

section in areas in which active corrosion is found. The company shall determine the areas of active corrosion by electrically survey, or where electrical survey is impractical by the study or corrosion; and leak history records by leak detection survey, or by other means.

12.9 INTERNAL CORROSION CONTROL

12.9.1 New Installations

(a) Internal corrosion is recognized in the operation of liquid pipelines, and a commodity that will corrode the internal surfaces of pipe and components in a piping system shall not be transported unless the corrosive effect of the commodity has been investigated and adequate steps taken to mitigate internal corrosion. It is usually necessary to control internal corrosion in petroleum products and liquefied petroleum gas pipelines to protect product quality, preserve high line efficiencies, and prevent corrosion of internal surfaces. NACE RP-01-75 provides guidance. Frequent scraping, pigging, or sphering, dehydration, inhibition, or internal coating may be used to limit internal corrosion.

(b) If dehydration or inhibitors are used to control internal corrosion, sufficient coupon holders or other types of monitoring techniques shall be utilized to adequately determine the effectiveness of the internal corrosion control program.

(c) If internal coatings are used to control corrosion, they shall meet the quality specifications and minimum dry film thickness established in the industry and be inspected in accordance with industry recommended practices.

12.9.2 Existing Piping System

The operating company shall establish procedures for determining the corrosive effect of the commodity being transported, and the internal condition of its existing piping systems, and take appropriate action for the conditions found, including, but not limited to, the following.

Examine and study records available from previous inspections and conduct additional inspections and investigations where the need for additional information is indicated.

12.9.3 Monitoring

(a) If scraping, pigging, or sphering, dehydration, inhibitors, or internal coating are used to control internal corrosion in new or existing piping systems, coupons shall be examined or other monitoring techniques utilized at intervals not exceeding 6 months to determine the effectiveness of the protective measures or the extent of any corrosion.

(b) Whenever any pipe or component in a piping system can be visually examined internally, or pipe or component is removed from a piping system for any

reason, the internal surfaces shall be inspected for evidence of corrosion, and if corrosion is found, the adjacent pipe or components shall be examined.

12.10 EXTERNAL CORROSION CONTROL FOR PIPING EXPOSED TO ATMOSPHERE

12.10.1 New Installation

Pipe and components that are exposed to the atmosphere shall be protected from external corrosion by use of corrosion resistant steel or application of protective coating or paint unless the operating company can demonstrate by test, investigation, or experience in area of application that a corrosive atmosphere does not exist. Protective coating or paint shall be applied to a clean surface and shall be suitable material to provide adequate protection from the environment.

12.10.2 Existing Piping Systems

Pipe and components in existing piping systems that are exposed to the atmosphere shall be inspected in accordance with a planned schedule and corrective measures shall be taken.

12.10.3 Monitoring

Protective coating or paint used to prevent corrosion of pipe and components exposed to the atmosphere shall be maintained in a serviceable condition, and such protective coating or paint, as well as bare pipe and components not coated or painted, shall be inspected at intervals not exceeding 3 years.

12.11 CORRECTIVE MEASURES

(a) In the case of external corrosion of buried or submerged piping, cathodic protection shall be installed or augmented to mitigate the external corrosion.

(b) In the case of internal corrosion of piping, steps shall be taken or augmented to mitigate the internal corrosion.

(c) In the case of external corrosion of piping exposed to the atmosphere, protection coating or paint shall be repaired or applied to mitigate the external corrosion.

(d) Pipe that is replaced because of external corrosion shall be replaced with coated pipe if buried or submerged, and with corrosion resistant steel pipe or coated or painted pipe if exposed to the atmosphere.

(e) If a portion of the piping system is repaired, reconditioned or replaced or operating pressure is reduced because of external or internal corrosion the need for protection of that portion from such corrosion deterioration shall be considered and any indicated steps shall be taken to control the corrosion.

12.12 RECORDS

(a) Records and maps showing the location of cathodically protected piping, cathodic protection facilities and neighboring structure affected by or affecting the cathodic protection system shall be maintained and retained for as large as the piping system remains in service.

(b) Results of tests surveys and inspections required to indicate the adequacy of corrosion control measures shall also be maintained for the service life of the piping systems as well as records relating to routine or unusual inspections such as internal or external line conditions, when cutting line or hot tapping, shall be retained for at least 5 years.

REFERENCE

In this standard the following international standards and codes have been referred to and apply as mentioned:

ASME B31.3	Process Piping
ASME B 31.4	Liquid transportation systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia and Alcohols
API 610	Centrifugal Pumps for Petroleum, Petrochemical and Natural Gas Industries
API Std 620	Design and Construction of Large, Welded, Low-Pressure Storage Tanks,
API 650	Welded steel tank for oil storage
API 1104	Welding of Pipelines and Related Facilities.
NFPA 10	Portable Fire Extinguishers
NFPA 11	Standard for Low-, Medium-, and High-Expansion Foam
NFPA 12	Standard on Carbon Dioxide Extinguishing Systems
NFPA 12A	Standard on Halon 1301 Fire Extinguishing Systems
NFPA 13	Installation of Sprinkler Systems
NFPA 14	Standard for the Installation of Standpipe, Private Hydrants, and Hose Systems
NFP 16	Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray
NFPA 20	Installation of Stationary Pumps for Fire Protection
NFPA 22	Water Tanks for Private Fire Protection
NFPA 24	Installation of Private Fire Service Mains and their Appurtenances
NFPA 30	Flammable and combustible code.
NFPA 70	National Electric Code
NACE	Applicable codes

ABBREVIATIONS

API	American Petroleum Institute
ASME	The American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
MSS	Manufacturers Standardization Society
NACE	National Association of Corrosion Engineers
NFPA	National Fire Protection Association
RP	Recommended Practice

[File NO. OGRA-5-6(1)/2006-Admn]

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