


INTERPLANT STANDARD - STEEL INDUSTRY		
	CODE OF PRACTICE FOR SELECTION, LAYING OF MOIST FUEL GAS LINES	IPSS:1-06-014-17 (Third Revision)
	<i>Corresponding IS does not exist</i>	Formerly : IPSS:1-06-014-02 (Second Revision)

0. FOREWORD

- 0.1 This Inter Plant Standard prepared by the Standards Committee on Pipes, Fittings, Valves and Piping Layout, IPSS 1:6 with the active participation of the representatives of all the steel plants and associated organization in the field, was adopted in July 2017.
- 0.2 This standard was first published in 1984. The revision was made in 1995 and 2002 to incorporate rationalization of pipes to be used. Further, during the usage of this standard, it was felt that certain changes are necessary to incorporate in this standard and the changes have been incorporated in this revision which are based on practical experience of the plant.

1. SCOPE

- 1.1 This Standard covers the guidelines for selection, laying and testing of moist fuel gas lines for gases emanating from blast furnace, coke oven, convertor, etc leading to the consuming points at various locations in the steel plants.

2. CLASSIFICATION

- 2.1 Depending upon the maximum working pressures, gas pipe-lines shall be sub-divided into the following categories :

a)	Low pressure- I	Upto 0.15 kg/cm ² (g)
b)	Low pressure- II	Gas pressure above 0.15 upto 1 kg/cm ² (g)
c)	Medium pressure- I	Gas pressure above 1 upto 3 kg/cm ² (g)
d)	Medium pressure- II	Gas pressure above 3 upto 6 kg/cm ² (g)
e)	High pressure	Gas pressure above 6 upto 12 kg/cm ² (g)

3. SELECTION OF STEEL PIPES FOR GAS LAYING

3.1 The selection of steel pipes depending on the maximum working pressure shall be done as given in Table-1. Dimensions and mass of the pipe shall be as given in Table-2.

3.2 Material - The plate used for manufacture of gas pipe shall conform to
IS 2062-2011 – E250 C (With copper content of 0.2% to 0.35 %)

OR

IS 2062-2011 – E410 C (With copper content of 0.2% to 0.35 %)

For seamless H.R. pipe the material shall conform to IS 1239 (Part 1):2004.

The flanges shall be manufactured from steel plates of parent material. Flanges above 20 mm thickness shall be stress relieved after fabrication.

TABLE - 1 SELECTION OF PIPES

S. No.	Pipe Designation	Nom. Dia mm	Min wall Thickness mm	Field of Application
1.	Seamless Hot Rolled	15-150	As per IS 1239 (Part 1):2004 (Heavy)/ ASTM A 106 Gr B Schedule 40	High pressure
2.	ERW pipe	15-150	As per IS 1239 (Part 1):2004 (Heavy)	Low & Medium pressure-I
3.	ERW pipe	200-400	6-8	All Low & Medium pressures
4.	Electric welded with spiral weld	500-1600	8-10	All Low & Medium pressures
5.	Shop fabricated pipe (Electric Fusion Welded - EFW)	800-3500	8-10	All Low pressures

TABLE - 2 PIPES FOR MOIST GAS LINES, DIMENSIONS, MASS

Nom. Dia Mm	OD Mm	Thickness mm	Mass per metre kg
200	219	6	31.52
250	273	6	39.51
300	324	6	47.05
350	355	6	51.64
400	406	8	78.52
500	508	8	98.65
600	610	8	118.77
700	711	8	138.70
800	813	8	158.82
900	914	10	222.94
1000	1016	10	248.09
1100	1118	10	273.25
1200	1219	10	298.16
1300	1321	10	323.31
1400	1422	10	348.22
1500	1524	10	373.38
1600	1626	10	398.53
1800	1820	10	446.37
2000	2020	10	495.70
2200	2220	10	545.02
2400	2520	10	594.34
2500	2520	10	619.00
2600	2620	10	643.67
2800	2820	10	692.99
3000	3020	10	742.31
3200	3220	10	791.63
3400	3420	10	840.96
3500	3520	10	865.62

3.3 Pipe Length - The pipe shall preferably be in random length of 6-7 or 10-12 m.

3.4 Deviation

3.4.1 *Straightness* - The finished pipe shall not deviate in straightness by more than 0.2% of the total length.

3.4.2 Outside Dia - The tolerance on outside diameter shall be :

a)	For ERW and EFW pipes	$\pm 0.75\%$ up DN 500
		$\pm 1\%$ for sizes above DN 500
b)	For seamless pipes	As per IS 1239: 2004

3.4.3 Wall thickness - The tolerance shall be :

a)	For seamless pipes	As per IS 1239:2004
b)	For others	$\pm 10\%$

3.5 Protective Coating

- a) The pipes shall be externally painted with one coat of redoxide primer conform to IS 2074:1992 before dispatch.
- b)* In certain areas like by-product plant where the gases are corrosive, BF and LD gas pipelines, the internal surface also shall be provided with protective coatings, either of the following:
 - i) Initial coat of primer of min 50 DFT (Dry Film Thickness) followed by one coat of suitable epoxy paint of 150 DFT (*for highly corrosive service*)
OR
 - ii) Initial coat of primer of min 50 DFT followed by two coats of black Bitumen paint (*for less corrosive service*)
OR
 - iii) Epoxy Zinc phosphate primer (80 DFT) followed by two coats of Vinyl coating containing Titanium Dioxide and chromium Oxide as pigment (2 coats, 50 DFT each)
OR
 - iv) Ceramic based epoxy / Polyurethane and Polyuria Coatings

* The indenter shall specify his exact requirements.

4. LAYING OF PIPE LINES

- 4.1 Gas lines of diameter 1000 mm and above shall be provided with stiffening ribs normally 3 metres apart. These stiffening ribs are also to be used for welding the supports for auxiliary pipes and walkway along with entire length of the pipe with hand rails. The spacings of the stiffening ribs may be reduced according to load due to a number of auxiliary pipes.
- 4.2 Slope of gas lines towards the nearest drain pot shall be 5 mm per metre length of the pipe.
- 4.3 The inter-shop and in-shop gas pipe lines shall be laid normally above the ground. The route of gas pipes shall be selected in accordance with the general layout of the plant taking into consideration the feasibility of

laying gas pipes and auxiliary network of other utilities. The route shall be laid by the side of the roads and parallel to the line of buildings and structures in the region.

- 4.4 After erection, the pipes shall be externally painted with one coat of primer and two coats of approved paint as per colour code.
- 4.5 Compensators - The selection of compensators shall be done as follows:
- a) Flanged gland compensators for inter shop coke oven gas line of dia above DN 300 and pressure up to 0.4 kg/cm² (g)
 - b) Disc compensators for B.F. gas, convertor gas, mixed gas and in-shop C.O. gas pipe lines for sizes above DN 300 & Pressure up to 0.4 kg/cm² (g)
 - c) U-bend compensators for all categories of gas line of diameter less than DN 300. It can be used for higher sizes also in case other types are not feasible
 - d) Corrugated expansion joints (bellow joints) for all application upto 6 kg/cm² (g) pressure
 - e) Fabric compensator for BF and converter gases of pressure up to 0.4 kg/cm² (g) (Not to be used in CO gas lines)
 - f) The compensator shall be expanded or compressed at the time of installation, as per ambient temperature condition.
- 4.6 Man Holes/Inspection Holes - Circular manholes of DN 600 diameter shall be provided within 1 metre length of each compensator for inspection purpose in the side having approach for pipes sizes 600 mm and more.
- In case of pipe of sizes 150-500 mm dia flanged cleaning holes of min 1/2 the pipe size or 80 mm whichever is higher shall be provided.
- 4.7 Supports of Gas pipes - While providing support, the following aspects shall be taken care of :
- a) Wooden supports to gas lines shall not be allowed, only steel or R.C.C. supports shall be provided.
 - b) Welding shall be continuous for all the elements of the metallic supports (no tack welding).

- c) The gas pipes shall be welded with the saddle. In doing so the transverse welding joints of gas pipes shall remain at least 300 mm from support and the longitudinal welds shall be above the supports, facing the front side; at no time the longitudinal welding seam shall come at the bottom 120° portion of pipe.

4.8 Installation of Gas Pipes with Other Pipes - While installing gas pipes with other pipes the following shall be kept in view :

- a) Additional pipes on existing gas pipes shall be allowed to be laid only with the permission of design organization and in each case the existing gas pipes and supporting structures shall be checked with due consideration for additional loads.
- b) It is allowed to make support directly on gas pipes with gas pressure up to 3 kg/cm² (g)
- c) The clear gap between gas pipe and associate pipe shall not be less than 300 mm for diameter of the associate pipe up to DN 500 and at least 600 mm for diameter above DN 500 except oxygen pipes.
- d) Oxygen lines shall be laid on either side of fuel gas line with a minimum gap of 800 mm.
- e) Pipes carrying corrosive fluids shall be kept at least 500 mm below or at gas pipe side. Coke oven gas shall be treated as corrosive fluid compared to blast furnace gas;
- f) Steam line shall be laid above or sideways of coke oven gas pipe to prevent fire hazards;
- g) Laying of the utility line directly below the gas line shall preferably be avoided.

4.9 Removal of a condensate from gas pipes and drainage water from drainages shall be done as follows :

- a) Drain pots shall be provided at a maximum distance of 100 metres within a radius of 100 metres from gas cleaning plants and 300 metres in the remaining portions.
- b) The size of the condensate drain shall not be less than DN 80. The condensate pipe shall have two rising spindle flanged gate valves,

one at a distance not exceeding 150 mm from the main gas pipe and other near the drain pot.

- c) Minimum height of the water seal in the condensate pot shall exceed by 500 mm over the maximum working pressure of gas but shall not be lower than 2000 mm.
- d) Separate drain pots shall be provided for different gases.
- e) Drain pots shall be provided with purging facilities and bleeder.

4.10 Points or purging of the gas lines

- a) Gas pipes along the entire length, after every 100-150 metres and also at places of installations of controlling accessories and drainage shall be equipped with arrangement for introduction of purging media (Steam/Nitrogen).

Note: Purging points shall not in any case be provided at bottom half of the main line.

4.11 Vent Pipes of Bleeders - These shall be installed as indicated below :

- a) Selection of the bleeders shall ensure 5 times discharge of the gas volume in 10-30 minutes. They shall be minimum DN 20 size.
- b) For in-shop piping, the top of the vent shall be located not less than 4 metres above the roof level;
- c) For interplant pipe lines, the height of the vents on gas pipe lines shall be not less than 4 m from the top of highest gas pipe. The exit points of vents shall be at a height not less than 12 m from the ground or 4 m above the accessible platform or 4 m above the top surface of highest gas lines, which is higher.
- d) Vent pipes of different gases shall not be connected through a common vent; and
- e) Design of top of the vent shall have T-piece with bird screen to prevent dust rain water etc entering the pipe. The vent pipe shall be tied with guy ropes/ structural support. Gas sample valves shall be provided after the vent valve.
- f) Rising spindle gate valves shall be provided in the vent.
- g) The gas installations and gas pipes shall have vent connection (bleeders) directly before a cut off device and also at the highest points of the closed circuit gas line.

- h) In case of mixing of gases vent valves shall also be provided after the isolating valves in each gas pipe to facilitate back charging.

4.12 Excess Gas Burner - Installation of excess gas discharging device shall be located at a distance of 30 metres along horizontal from the neighboring installations. The discharge pipes shall be not less than 15 metres above the buildings and service station.

In all, the height of the discharging unit shall be not less than 30 metres above the ground level for discharging up to 50000 m³/h and not less than 45 metres for higher quantity of gas and this device shall be of remote control type.

4.13 Minimum height/distance of gas pipes from different installations shall be kept as given below :

- a) Main gas pipe line of plant shall be laid keeping at least 6 metres height between the bottom of gas pipelines/ bottom of supporting structure (e.g pipe bridge) and the ground level road top whichever is lower.
- b) The height may be reduced to 5 metres in case of gas pipe-lines laid in regions where people generally do not walk and upto 3 metres when gas pipe line passes under bridges;
- c) When inside plant pipe-lines cross unelectrified railway tracks, the gas pipes shall be laid down at least at a height of 6 metres measuring from bottom of gas pipe / or its supporting structure whichever is lower to rail head and 7.1 metres when crossing electrified railway tracks; disconnection facility is desirable.
- d) Where inside plant pipe-lines cross railway tracks or transporting molten iron or slag the gas pipes are to be provided with fire-proof heat insulation protection.
- e) Laying of gas pipes along railway bridges is not allowed;
- f) When gas lines are laid along the wall of the building, the following distances shall be left between gas pipes and wall;

Diameter of pipes in mm	Minimum distance in mm
500 and more	500
From 200 to 500	300
Less than 200	150

Note 1: The gas pipes installed along building walls shall not intersect door and window way.

Note 2: In the region of gas pipes installed along external walls of buildings below window ways, installation of flanges and thread jointings and also installation of accessories are not allowed.

- g) When high / extra high voltage overhead line passes above gas pipe line, it shall have vertical clearance above the highest part of the pipe under such line of not less than :

i)	Upto 33 kV	3.7 metre
ii)	Above 33 kV	3.7 + 0.3 metre for every additional 33 kV or part thereof.

(This is based on regulation of IER)

NOTE: The sag of the overhead line shall be taken into account.

5. JOINING OF PIPES

- 5.1 The parts of gas pipes and gas equipments shall be joined with each other as a rule by welding. Joining by flanges shall be allowed at places where gas pipe is connected to equipment or in such areas where pipe replacement is frequent due to deposits/corrosion. Use of threaded joint shall be allowed for connecting control and measuring instruments and for minor accessories only.

6. TESTING OF GAS MAINS AND GAS EQUIPMENTS

- 6.1 All new gas lines and gas equipments after installations or after capital repairs shall be tested for tightness and strength. They shall be tested after they have been disconnected from other accessories and equipment and the control and measuring instrument. The portion of the gas lines or equipment under test shall be completely cut off from the live gas line by blanks of sufficient thickness to withstand the testing pressure.
- 6.2 Liquid manometer of water or mercury shall be used for a test pressure upto 1 kg/cm² (g) and spring type pressure gauge for a pressure above 1 kg/cm² (g).
- 6.3 Testing of lines for strength and leakage upto 3 kg/cm² (g) working is done by air or inert gas and by water for working pressure above 3 kg/cm² (g).

- 6.4 Gas lines situated inside the buildings shall be tested separate from that in outside open area.
- 6.5 Temperature shall be measured at the start of testing and also at the end of the testing with the help of thermometer kept in the gas line throughout the testing period.
- 6.6 Duration of testing for strength is only 15 minutes, but for leakage test the duration be 2 hr for working pressure upto 1 kg/cm² (g) and 12 hr for a pressure above 1 kg/cm² (g).

The value of pressure for testing shall be given below :

Working pressure (kg/cm ²)	Test pressure (kg/cm ²)	
	For strength	For leakage (tightness)
Upto 1 kg/cm ² (g)	----	1.25 P but not less than 1kg/cm ² (g)
More than 1 kg/cm ² (g) and upto 3 kg/cm ² (g)	4.5 kg/cm ²	1.25 P but not more than 3 kg/cm ² (g)
More than 3 kg/cm ² (g) and upto 6 kg/cm ² (g)	7.5 kg/cm ²	1.25 P but not more than 6 kg/cm ² (g)
More than 6 kg/cm ² (g) and upto 12 kg/cm ² (g)	15 kg/cm ²	1.25 P but not more than 12 kg/cm ² (g)
P = maximum working pressure in kg/cm ² (g)		

NOTE: All the pressure mentioned in the IPSS are gauge pressure.

- 6.7 Percentage of leakage shall not be more than the following values for outdoor pipelines during the test duration as per clause 6.6 above:

Size of the pipes diameter in mm	Leakage allowed, percent
Upto 300	2
Above 300 upto 1000	1.5
Above 1000	1.0

All the gas lines in the premises of inside the shop building and closed area shall not have leakage more than 1% irrespective of sizes of pipes.

- 6.8 Percentage of leakage is calculated according to the following formula :

$$\Delta P = 100 \left(1 - \frac{P_F \times T_I}{P_I \times T_F} \right)$$

Where

▲P	=	Leakage percentage
P ₁	=	Initial pressure (kg/cm ² , absolute)
P _F	=	Final pressure (kg/cm ² , absolute)
T _I	=	Absolute temperature of air inside the gas pipe at the start of test(°K)
T _F	=	Absolute temperature of air inside the gas pipe at the end of test(°K)

7. GENERAL

- 7.1 The gas pipes shall be normally painted with a base of zinc based red oxide paint and final colour shall be painted according to the colour code for the specific gas.

The gas pipes which pass through regions having corrosive gases and vapours shall be coated by special anti-corrosive coating and mounted R.C.C. supports.

- 7.2 In order to service valves, throttles, measuring instruments installed at a height of 2 metres or more, stationary platform with stairs shall be provided.
- 7.3 Isolation device like blanking or water-seal facilities shall be provided on the branch lines to individual consuming unit.
- 7.4 Only one exit shall be built from platform of gas scrubber, electro-filters, gas discharging devices. For stairs intermediate landing shall be provided for every 3 m.
- 7.5 The gas pipes shall be earthed to earth circuit of the shop installation at the entrance into shop building and at the exit. The inter plant pipelines shall also be earthed through supportive structure at interval of 100-150 m.
- 7.6 All the gas installations shall be equipped with protection against lightening in accordance with the relevant rules.
- 7.7 Installation of safety valves / explosion flap against explosion on gas pipes and gas equipments are not recommended. This shall only be provided if specified by the indenter.
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