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PETROLEUM AND NATURAL GAS REGULATORY BOARD

NOTIFICATION

New Delhi, the 19th May 2015

F. No. Infra/PNGRB/Capdet/CGD/02/2015.—In exercise of the powers conferred by section 61 of the Petroleum and Natural Gas Regulatory Act, 2006 (19 of 2006), the Petroleum and Natural Gas Regulatory Board hereby makes the following regulations, namely:—

1. Short title and commencement.

(1) These regulations may be called the Petroleum and Natural Gas Regulatory Board (Determining Capacity of City or Local Natural Gas Distribution Network) Regulations, 2015.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Definitions.

(1) In these regulations, unless the context otherwise requires,-

(a) "Act" means the Petroleum and Natural Gas Regulatory Board Act, 2006;

(b) "appointed day" means the date of October 1, 2007 when the Central Government notified the establishment of the Petroleum and Natural Gas Regulatory Board;

(c) "authorized area" means the area as defined under the Petroleum and Natural Gas Regulatory Board (Authorizing Entities to Lay, Build, Operate or Expand City or Local Natural Gas Distribution Networks) Regulations, 2008;

(d) "authorised entity" means an entity that is authorised to lay, build, operate or expand a city or local natural gas distribution network in a geographical area (GA) under the Act and the relevant regulations made thereunder;

(e) "Board" means the Petroleum and Natural Gas Regulatory Board established under sub-section (1) of section 3 of the Act;

(f) "capacity assessment group" means a group comprising representatives of two authorised entities other than the entity of which the CGD network capacity is to be certified and a representative of the Board as decided by the Board on case to case basis or any agency or entity or authorized person or any approved third party authorized by the Board for determining the capacity of the CGD network;

(g) "CGD network capacity" means the maximum quantity in standard cubic metres per hour (SCMH) of natural gas that can be injected into or off taken from the steel pipeline network at specific points, meeting all the technical and operational parameters fixed in steel network at steady state conditions, that is, all parameters like flow, pressure, temperature, are in harmony and vary only along the steel network but not with time or the aggregate rated capacity (in SCMH) of all City Gate Stations (CGS) connected to steel network, whichever is lower. For cases, where any entry points (CGS/DPRS/custody metering systems) are connected directly to the medium density poly ethylene (MDPE) network without involvement of any steel network, the rated capacity of such entry points shall be considered;

(h) "CGD declared capacity" means the capacity (in SCMH) that the steel pipeline network is capable of distributing under the steady state operating conditions determined based on the approved flow equation and the selected software package or the aggregate rated capacity (in SCMH) of all City Gate Stations connected to steel network, whichever is lower. For cases, where any entry points (CGS/DPRS/custody metering systems) are connected directly to the MDPE network without involvement of any steel network, the rated capacity of such entry points shall also be declared;

(i) "city or local natural gas distribution network" (hereinafter referred to as CGD network) means a pipeline network as defined under clause (i) of section 2 of the Act;

(j) "CNG Station Capacity" shall be the maximum rated capacity of running compressors at respective stations or the maximum capacity determined at the inlet flange of the compressors whichever is lower;

(k) consumer" means consumer as defined under clause (d), (e), (f) or (g) of sub- regulation 1 of regulation 2 of the Petroleum and Natural Gas Regulatory Board (Code of Practice for Quality of Service for City or Local Natural Gas Distribution Networks) Regulations, 2010;

(l) "operator" means an entity that operates CGD network with authorization of the Board;

(m) "selected software package" means the software package used by the entity for determination of capacity of the CGD network;

(n) "steady state condition" means calculation carried out based on time-invariant pressure, temperature and flow profiles throughout a steel pipeline network using specified boundary conditions and network element set points that are entered. In other words, the steady-state run calculates the hydraulic state of a network operating at equilibrium;

(o) "steel pipeline network" means the steel pipeline laid and commissioned originating from the source (primarily at tap-off point from any transportation / transmission /primary network or city gate station) up to the Distribution Pressure Regulating Station or District Regulating Station (DPRS or DRS), Metering and Regulating Station (MRS) and inlet flange of CNG compressor station;

(p) "third party contracted capacity" means the quantity (in SCMH) of natural gas contracted with any third party for transportation through a pipeline system;

(2) Words and expressions used and not defined in these regulations, but defined in the Act or in the rules or regulations made thereunder, shall have the meanings respectively assigned to them in the Act or in the rules or regulations, as the case may be.

3. Applicability

(1) These regulations shall apply to an entity which is laying, building, operating or expanding or which proposes to lay, build, operate or expand a city or local natural gas distribution network.

(2) These regulations cover the procedure, parameters both constant and variable and frequency of declaration of CGD network capacity in SCMH for CGD network.

(3) These regulations shall not be applicable to sub-transmission pipelines, MDPE network system downstream of DPRS/DRS and service lines, including GI/copper piping of CGD network.

Note: In case, any sub-transmission pipeline has been laid by the authorised entity, the details of the same upto CGS or upto connectivity with primary network in the authorized GA shall be provided by the entity as per Annexure-3. The capacity of sub-transmission pipeline from Custody Transfer Flange downstream of connectivity from transmission pipeline upto CGS or upto connectivity with primary network in the authorized GA shall also be determined.

4. Objective.

(1) It is intended to apply these regulations to all CGD networks for the purpose of declaration of CGD network capacity.

(2) The capacity of the CGD network so determined shall be used for providing access to shipper on non-discriminatory basis under the Petroleum and Natural Gas Regulatory Board (Access Code for City or Local Natural Gas Distribution Networks) Regulations, 2011.

5. Determining capacity of a City or Local Natural Gas Distribution Network.

(1) The determination of capacity for the CGD network shall be based on selected software package and flow equation approved by the Board under these regulations. It is not necessary for the entities to buy and install any specific software package. The entities may continue to use or operate the system based on the previously installed software but shall have to determine the capacity of the system based on the flow equation approved by the Board in any of the selected software package for the purpose of these regulations.

(2) The entity while submitting the capacity of the CGD network to the Board, shall furnish a declaration that the capacity has been calculated using the approved flow equation. The entity shall also submit the detailed report of the capacity and indicate the software used for the purpose within ninety days of the notification of these regulations and thereafter as per the periodicity for determining capacity of CGD network defined in regulation 7.

(3) The parameters for running the steady state simulation for determining the CGD network capacity shall be considered as given below, namely:-

(a) **Constant parameters** in the unit as specified in the approved flow equation as per sub-clause (v) of this clause.

(i) **Internal diameter (ID)** – The internal diameter shall be determined by deducting twice the thickness from outer diameter of steel pipes used in the CGD network. Further, the internal diameter shall be determined based on weighted average of internal diameters based on different pipe thicknesses used in different sections in the pipeline system.

(ii) **Length –** The actual length (for already installed pipeline) or proposed length (for yet to be installed pipeline) of the pipe in the pipeline system.

(iii) **Roughness –** This is a fixed value for a pipe which determines the unevenness inside a pipe. Depending on the pipe material, the below given value for roughness factor shall be used :

Type of Material	**Roughness (micron)**
Steel – New Pipe (up to ten years old)	
- With internal coating	10-15
- Without internal coating	25-45
Steel–Old Pipe (more than ten years old)	
- With internal coating	15-20
- Without internal coating	45-100

For old pipelines already operating, roughness factor shall be determined by duly calibrating actual field data in the approved flow equation. These factors shall be assessed by the capacity assessment group. For new pipelines, roughness factor used shall be decided keeping in view the operating conditions and pipeline feature like bends, valves, or any other restrictions present in the system:

Provided that the entity shall declare in advance the roughness factor considered for the pipes with relevant operating data to support the value chosen.

(iv) **Efficiency factor –**

Steel Pipeline – Efficiency factor within the range of 0.85 to 1.0 shall be used. For old pipelines already operating, efficiency factor shall be determined by duly calibrating actual field data in the approved flow equation. These factors shall be assessed by the capacity assessment group. For new pipelines efficiency factor used shall be decided keeping in view the operating conditions and pipeline feature like bends, valves, life of pipeline or any other restrictions present in the system:

Provided that the entity shall declare in advance the efficiency factor considered for the pipes with relevant operating data to support the value chosen giving complete analysis. The Board may direct the entity to improve upon such design.

(v) **Formula –** For determination of flow rate and pressure drop in the pipeline, the following flow equation shall be used:

Type of Network	Name of Flow equation
Steel Network	Colebrook White / Fundamental pipe equation with flow dependent (Colebrook White) friction factor

(vi) **Velocity** – The maximum allowable velocity of the gas in the steel pipeline section of CGD network shall be 30 m/s.

(vii) The steel pipeline network capacity shall be determined at maximum operating pressure (MOP) for the CGD network and with the following standard Pressure and Temperature conditions:

Standard pressure – 1.01325 bar (a).
Standard temperature – 15.56 degree C

(b) Varialble parameters-

(i) **Operating temperature** – For the purpose of determining the capacity and for annual capacity declaration to the Board, the summer temperature of 30 ºC shall be considered by all the entities.

(ii) **Inlet temperature** – This is the actual inlet temperature (º C) of the gas from the source into the CGD network.

(iii) **Outlet temperature**- This is the actual outlet temperature (º C) of the gas at the delivery point.

(iv) **Inlet pressure** – The maximum pressure (in barg) that is available at the entry point to the CGD network and shall be declared by the CGD entity during capacity declaration.

(v) **Outlet pressure** – The minimum pressure (in barg) that is required by the consumer at the delivery or exit point as per access arrangement entered into by the shipper and the authorised entity.

(vi) **Maximum operating pressure (MOP) –** This is the highest pressure (in barg) at which a CGD Network operates during normal operating cycle and shall be declared by the CGD entity for capacity determination. However, in case an entity is operating the CGD network at certain pressure which is at variance from above for more than or equal to five years, need to submit calculation carried in line with the Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for City or Local Natural Gas Distribution Networks) Regulations, 2008 and ASME B31.8 (Latest edition) supporting the revised MOP considered in determination of CGD network capacity. For the purpose of determining MOP, the Board shall be guided by incoming pressure at city gate station or custody transfer point.

Note: In case, any sub-transmission pipeline has been laid by the CGD entity, the details of the same upto the connectivity with primary network in the authorized GA shall be provided by the entity as per Annexure-3 for the purpose of arriving at the incoming pressure at the entry of primary network in the authorized GA.

(vii) **Minimum committed pressure (MCP) –** This is the minimum pressure (in barg) at the exit points and shall be declared by the CGD entity during capacity declaration.

(viii) **Source supply flow** – This is the maximum flow (in SCMH) that can be available from the source (primarily a Tap-off point from any Transportation / Transmission / Sub-Transmission Pipeline or City Gate Station).

(ix) **Delivery flow** – This is the maximum flow (in SCMH) that is required by the consumers at the exit point as per access arrangement entered into by the shipper and the operator.

(x) **Elevation difference** – Depending on the terrain of the ground profile, this factor will be considered from the mean sea level of the area.

(xi) **Gas composition** – The gas composition indicating all components totaling 100% by volume is to be given with the level of impurities as per the Petroleum and Natural Gas Regulatory Board (Access Code for City or Local Natural Gas Distribution Networks) Regulations, 2011. From this, necessary input to the flow equation shall be worked out.

In case of more than one source, the weighted average composition of commingled natural gas beyond the second source of entry point shall be considered.

(xii) In case of CGD network, the gas quality at exit point shall be as per the Petroleum and Natural Gas Regulatory Board (Access Code for City or Local Natural Gas Distribution Networks) Regulations, 2011.

(4) All entities shall declare to the Board the constant parameters and the variable parameters for the CGD network -

(i) on first working day of October every year; and

(ii) whenever there is any addition or deletion of the supply source of natural gas.

The entities shall also provide on first working day of October the network diagram superimposed on the authorized area map for the CGD network.

(5) The methodology for calculation of CGD network capacity shall be as under:

(i) The entire steel pipeline network shall be configured in the selected software package operating offline. The steady state condition of the pipeline hydraulics with variable parameters (pressure, temperature and flow) at entry that is downstream flange of City Gate Station and declared exit points shall be simulated in the selected software package.

(ii) Assuming gas at the entry point (single source or multiple source of gas) is unlimited, the selected software shall be run till inlet flange of any industrial PRS, DRS and CNG Compressor connected to the system till it reaches limiting condition of pressure required at any exit point or limiting velocity in steel pipeline network as calculated by software or maximum flow capacity is reached at exit points.

(iii) After satisfactory completion of simulation, add dummy load at the farthest exit points of steel network, considering the minimum committed pressure.

(iv) Now, simulate the steel pipeline network till inlet flange of any industrial PRS, DRS, CNG Compressor and dummy load connected to the system reaches limiting condition of pressure required or limiting velocity in pipeline as calculated by software or maximum flow capacity is reached at exit points.

(v) The sum of flow (in SCMH) at each exit point (i.e. Inlet flanges of Industrial PRS, DRS and CNG compressor) and dummy load in all the charge areas is the total steel network capacity.

(vi) The entity shall submit the details of maximum achievable steel network capacity so derived, under the steady state simulation with the details of variable and constant parameters, to the Board in the specified format at Schedule A along with the hydraulic gradient and system flow diagram for the steel network system. The entity shall submit the details of rated capacity of all entry points (CGS/DPRS/custody metering systems) including entry points, if any, connected directly to the MDPE network without any steel pipeline in between along with details of rated capacity of exit points like DRS/IPRS/CNG station etc. in Annexure-1.

(vii) The capacity of CGD network shall be as per the operation days specified in the Petroleum and Natural Gas Regulatory Board (Access Code for City or Local Natural Gas Distribution Networks) Regulations, 2011 for respective system.

(viii) If the aggregate CGS capacity is less than the determined steel network capacity, then, the aggregate CGS capacity shall be considered as the steel network capacity.

(ix) The steel network capacity so determined shall be the CGD network capacity provided that if any entry point (CGS/DPRS/custody metering systems) is connected directly to the MDPE network without involvement of any steel network, the rated capacity of such entry point shall also be considered for the purpose of capacity declaration.

6. Declaring capacity of a City or Local Natural Gas Distribution Network by the Board.

(a) The Board, after having analyzed the report submitted by the entity regarding capacity of the CGD network with respect to the provisions of these regulations, shall decide-

(i) to reject the capacity so determined and direct the entity to revise the capacity calculations based on the revised parameters; or

(ii) to go ahead with the proposal with or without modification.

(b) The capacity so determined shall be declared by the Board as the capacity of the CGD network. The Board shall declare the capacity of the CGD network in the format specified at Schedule B.

(c) The entity, after declaring the CGD network capacity by the Board, shall publish the same in line with the provisions of the relevant Regulations on the Petroleum and Natural Gas Regulatory Board (Access Code for City or Local Natural Gas Distribution Networks) Regulations, 2011, on their website.

7. Periodicity for determining capacity of city or local natural gas distribution networks.

(i) The capacity of a CGD network shall be determined on first working day of October every year or whenever there is a change in quantity of natural gas plus or minus 10% of previous declared capacity due to any of the following :

(a) change in quality of gas,

(b) modification, upgradation, addition or deletion of entry or exit points,

(c) addition or deletion of loop lines, compressor etc.

(ii) The entity shall submit the details of the so re-determined capacity of the pipeline to the Board in line with the provisions of these regulations for the purpose of declaration of capacity.

8. Miscellaneous.

(1) If any dispute arises with regard to the interpretation of any of the provisions of these regulations, the decision of the Board shall be final.

(2) The Board may, either suo moto or on a complaint, refers the issue of determination of the capacity of a CGD network, to any external consultant or expert. Cost in this regard shall be borne by the entity or the complainant or as deemed fit by the Board on a case specific basis. However, the recommendation of the consultant or expert shall be advisory in nature to the Board and shall not be binding.

(3) The Board may validate the computed capacity with actual capacity as per the flow regime of the pipeline with actual flow conditions as and when desired.

SCHEDULE A

[see regulation 5(5) (vi)]

Format for furnishing information regarding determination of CGD network capacity

Date of submission of capacity to the Board: ……

Applicable for the period: _____

1	Name of entity	
2	Address and contact details of entity	
3	Name of CGD network	
4	Length and diameter of steel pipeline network (attach complete details with diagram)	
5	Name of software package used	
6	Confirm Colebrook White equation / Fundamental pipe equation with flow dependent (Colebrook White) friction factor is used	Yes/ No
7	Details of injection/entry points, delivery or exit points (Location, diameter, pressure, temperature, rated capacity, actual flow rate etc.) and charge areas in CGD networks. Details to be given as per Annexure 1.	
8	Composition of natural gas. Details to be given for each entry point as per Annexure 2.	
9	Entity agrees to have complied with the technical standards, specifications and safety standards as specified by the Board	Yes/ No
10	Entity agrees to have complied with the provisions of other relevant Petroleum and Natural Gas Regulatory Board Regulations	Yes/ No
11	Constant and variable parameters used under steady state conditions for determining capacity of the steel network in CGD networks as per Annexure 2 .	
12	Maximum achievable capacity of the steel network under steady state conditions as determined under regulation 5 of these regulations	
13	Aggregate of rated capacity of all entry points connected to steel network (Details of	

	each CGS/entry point to be provided separately in Annexure 1)	
14	Rated capacity of entry points (CGS, PRS and Custody Metering Systems), if any, connected directly to MDPE network (Details of each entry point to be provided separately in Annexure 1)	
15	Maximum achievable capacity of the steel network (lower of Sl. No. 12 or 13)	

Note: Submit network diagram superimposed on the authorized area map for the CGD network along with the hydraulic gradient and system flow diagram for the steel network.

[Sign. & Stamp of Authorized Signatory of the Entity]

SCHEDULE B

[see regulation 6(b)]

Format for declaring capacity of City or Local Natural Gas Distribution Networks

Date of declaration of capacity by the Board: ……

Applicable for the period: _____

1	Name of entity	
2	Address and contact details of entity	
3	Name of CGD network	
4	Details of injection or entry points and delivery or exit points connected to steel networks (location, diameter, pressure, temperature, rated capacity etc.) and charge areas in CGD networks (details enclosed)	
5	Details of rated capacity, location, pressure etc. of each injection or entry point connected directly to MDPE network without any steel network in between	
6	Name of the software package used by the entity	
7	Flow equation used for the purpose	
8	Gas composition considered for the purpose of capacity determination of steel network in CGD.	
9	Maximum achievable capacity of the CGD steel network under steady state conditions.	
10	Maximum achievable capacity of sub-transmission pipeline laid, if any.	
11	Aggregate of rated capacity of all entry points connected to steel network	
12	Maximum capacity of the steel network (lowest of Sl. No. 9,10 or 11 above)	
13	Rated capacity of entry points (CGS, DPRS and Custody Metering Systems), if any, connected directly to MDPE network (Details of each entry point enclosed)	

Dated:

Secretary

Petroleum and Natural Gas Regulatory Board

K. Rajeswara Rao, OSD (R)

[ADVT-III/4/EXTY./188/15(62)]

Annexure-1

[see regulation 5 (5)(vi)]

Format for furnishing Details of Injection/ Entry points and Delivery/ Exit points

1.	Name of entity	
2.	Address and contact details of entity	
3.	Name of CGD Network	
4.	Details of Entry and Exit Points on Steel Network	
a)	Entry Point 1: ➢ Name: ➢ Location: ➢ Internal Diameter of Pipe (after entry point): ➢ Length of Steel Pipe (give details with diagram): ➢ Class/Thickness of Pipe: ➢ MOP as per Class of Pipe: ➢ Revised MOP, if any (enclose technical justification and supporting calculation in terms of these Regulations): ➢ Pressure: i) at upstream of Entry Point ii) at downstream of Entry point ➢ Inlet temperature: ➢ Maximum Rated Capacity (in SCMH) of Entry Point (enclose certified Technical Documents): [**Note:** Provide similar details for all other entry points. Also, provide relevant details for entry points connected directly to MDPE network]	
b)	Exit Point 2: ➢ Name: ➢ Location including name of Charge Area: ➢ Internal Diameter of Steel Pipe (before exit point): ➢ Length of Steel Pipe till upstream of Exit Point: ➢ Class/Thickness of Pipe: ➢ MOP as per Class of Pipe: ➢ Revised MOP, if any (enclose technical justification and supporting calculation in terms of these Regulations): ➢ Pressure: i) at upstream of Exit Point ii) at downstream of Exit Point ➢ Temperature: ➢ Maximum Rated Capacity (in SCMH) of Exit Point (enclose certified Technical Documents): [Note: Provide similar details for all other exit points]	

Annexure-2

[see schedule A (8) and (11)]

Format for furnishing Details of Constant and Variable parameters of Steel Network and Gas Composition at Injection or Entry points and Delivery or Exit points

a) Constant parameters:

Parameter	**Details**
Name of Steel Pipe/ Section:	
Internal Diameter (mm/inch)	
Length (Km)	
Pipeline Roughness (micron) [Enclose Technical Justification]	
Efficiency Factor/Pipeline Efficiency (%)[Enclose Technical Justification]	
Formula/ Gas Flow Equation Used	
Velocity (m/s)	
STP	Standard pressure: 1.01325 bar (a) Standard temperature : 15.56 deg C

Note: i) Similar Details for all steel pipes/ sections, size changes etc. may be provided.

ii) Pressure drop at Rated Capacity pertaining to each entry point may be provided (enclose Technical document)

a) Variable parameters:

Parameter	**Details**
Name of Steel Pipe/ Section:	
Operating Temperature (30 deg C)	
Inlet Temperature (deg C)	
Inlet Pressure (kg/cm2g or barg)	
Outlet Pressure (kg/cm2g or barg)	
Maximum Operating Pressure (kg/cm2g or barg) [Enclose Justification]	
Minimum Committed Pressure (kg/cm2g or barg) (Enclose relevant documents)	
Velocity (m/s)	
Supply Source Flow (MMSCMD)	
Delivery Flow (MMSCMD)	
Elevation Difference	
Gas Composition (Mole Percent) Methane: Ethane: Propane: Isobutene: Isopentene: Hexane: Nitrogen: Sp. Gravity: GCV: Kcal/SCM NCV: Kcal/SCM	 GCV: Kcal/SCM NCV: Kcal/SCM

Annexure-3

[see regulations 3 and 5]

Format for furnishing Details of Constant and Variable parameters of Sub-Transmission Pipeline (STPL)

a) Constant parameters:

Parameter	Details
Name of steel pipeline/section:	
Name and Location (with longitude/latitude) of inlet and outlet of STPL i.e. from custody transfer point to connectivity with primary network	
Internal Diameter (mm/inch)	
Length (Km)	
Pipeline Roughness (micron) [Enclose Technical Justification]	
Efficiency Factor/Pipeline Efficiency (%)[Enclose Technical Justification]	
STP	Standard pressure – 1.01325 bar (a) Standard temperature –15.56 degree C

a) Variable parameters:

Parameter	Details
Name of Steel Pipe/ Section:	
Operating Temperature (30 deg C)	
Inlet Temperature (deg C)	
Inlet Pressure (kg/cm2g or barg)	
Outlet Pressure (kg/cm2g or barg)	
Maximum & Minimum Committed Pressure (kg/cm2g or barg)	
Elevation Difference	
Gas Composition (Mole Percent) Methane: Ethane: Propane: Isobutene: Isopentene: Hexane: Nitrogen: Sp. Gravity: GCV: Kcal/SCM NCV: Kcal/SCM	 GCV: Kcal/SCM NCV: Kcal/SCM

Note: Copies of agreement/tie-in agreement with transporter/transmission entity indicating agreed/ committed delivery pressure, temperature etc to be provided.

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