SGN/SP/NP/14

Version No 2021 12 02

SPECIFICATION FOR

THE DESIGN OF SYSTEM EXTENSIONS, CONNECTIONS AND SERVICES TO SGN'S BELOW 7 BAR SYSTEMS

DECEMBER 2021

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FOREWORD

This Specification was approved by John Kenny on 02/12/2021 for use by managers, engineers and supervisors throughout SGN.

SGN documents are revised, when necessary, by the issue of new editions. Users should ensure that they are in possession of the latest edition by referring to the SHE & Engineering Document Library available on Digital Hub.

Compliance with this safety and engineering document does not confer immunity from prosecution for breach of statutory or other legal obligations.

BRIEF HISTORY

First published as T/PR/NP14	May 2001	EPSG/L00/137
Editorial update to reflect demerger	October 2001	
Editorial update to reflect Safety Case version 3 taking into account issues as detailed in the comments below. Additionally compliance with mandatory terms along with the removal of non-specific normative phrases.	March 2004	EPSG/A04/10036
Editorial update to correct typographical errors	October 2004	
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Revised and re-issued	December 2021	SMF-911-10092021

KEY CHANGES

Section	Amendments
All	Updated to newer SMF Specification template.
All	General update for roles & responsibilities, updated procedure references, terminology and working practices within SGN.
1	Non-typical analysis added to the scope of the procedure.
6.1	Bullet points added for network analysis requirements.
6.6	Updated to include the requirement for source pressure of 21mb to be used for design.
8.3	New requirement added to state that manifold connections must not be used.
8.4	New section added to specify requirements for 'FastTrack' applications.
9	More information added for non-typical demands.
10.4	Table A3 updated to 280mb from 270mb.
11.1	Velocity section updated to include design gas velocity for mains.

DISCLAIMER

This safety and engineering document is provided for use by SGN and such of its contractors as are obliged by the terms and conditions of their contracts to comply with this document. Where this document is used by any other party it is the responsibility of that party to ensure that this document is correctly applied.

MANDATORY AND NON-MANDATORY REQUIREMENTS

In this document:

must: indicates a mandatory requirement.

should: indicates best practice and is the preferred option. If an alternative method is used then a suitable and sufficient risk assessment must be completed to show that the alternative method delivers the same, or better, level of protection.

SPECIFICATION FOR THE DESIGN OF SYSTEM EXTENSIONS, CONNECTIONS AND SERVICES TO BELOW 7 BAR SGN SYSTEMS

1. SCOPE

This Specification is for the:

- Design of all new mains, services, and network risers.
- Review of designs submitted by third parties for evaluation.
- Evaluation of new or increased loads where there are no new pipes to be installed.
- Analysis of non-typical loads.

2. REFERENCES

This Specification makes references to the documents listed in Appendix A. Unless otherwise specified, the latest edition of the documents apply, including all amendments.

3. DEFINITIONS

The requirements and definitions applying to this Specification are listed in Appendix B.

4. PURPOSE

To provide a consistent and defensible approach to the sizing of services, connections, and the quotation of design pressures.

5. ASSUMPTIONS

This document defines how the physical design of any pipe, subject to a new or modified demand, which is to be connected to SGN's parent main, shall be undertaken.

The connection for all demands, including Condition 16 (C16) loads, is to be designed in accordance with this document.

6. REQUIREMENT FOR NETWORK ANALYSIS / SECURITY OF SUPPLY

6.1 Network analysis requests

All requests received for new or increased loads to be fed from SGN's network must be assessed to determine if full Network Analysis is required at the quotation stage. Refer to Section 10 - Table A1 and Table A2.

If the request falls outside the scope of Table A1 or Table A2, it must be referred for full Network Analysis and cannot be 'Fastracked'.

The scope for full Network Analysis is:

- New or increase of existing loads in excess of the specified values in Tables A1 and A2.
- Requests for pressures higher than those quoted in Tables A2 and A3.
- New loads proposed to be taken from an Intermediate Pressure (IP) system.
- New loads considered to be 'Non-typical', see Section 9.
- New or increase of existing loads to be supplied from one of the Scottish Independent Undertakings (SIU's).

Where network analysis is required as part of providing a quotation then this should be carried out in accordance with Section 14.

6.2 Standard / Guaranteed pressures

Standard or guaranteed pressures have been developed to avoid the need to undertake full network analysis at the quotation stage. The scope of guaranteed pressures extends to low pressure load requests up to 1733kW/160scmh with the exception of load requests >900kW <=1733kW off <=2"/63mm mains and those falling within the above criteria for full, pre-acceptance Network Analysis.

The scope of guaranteed pressures also extends to medium pressure load requests up to 2167kwh / 200scmh with the exception of those falling within the above criteria for full, pre-acceptance Network Analysis.

Refer to Section 10 - Tables A1, A2 and A3.

6.3 Post acceptance security of supply checks

Post acceptance Security of Supply (SOS) checks may be required when standard pressures have been taken from Tables A2 and A3. SOS checks that require referral to network analysis are necessary when the load exceeds the threshold for network analysis using Table A1 or Table A2.

The SOS check should be carried out to ensure that capacity is available to support the load increase. Any shortfall in capacity should be met, at SGN's cost, before the load can be connected.

The process for undertaking post acceptance SOS assessment and notifying the customer of any variation to lead times for provision of capacity previously quoted, must be in accordance with SGN Connections Policy.

6.4 Results retention

Network analysis results should be retained for audit purposes, refer to Section 15.

6.5 Minimum parent main pressures for LP network extensions

The values in Section 10 - Table A2 represent the minimum pressures to be quoted where a multiple meter point mains extension is subject to network analysis as part of the quotation process.

6.6 Minimum design minimum pressures for new LP services

New load requests for a single meter point or two-meter points when designed as a Dual Service or a CSEP request with an AQ >2,196,000 kWh will be quoted and should be designed with a source pressure of 21mbar.

6.7 Minimum parent main pressures for MP network extensions and new services

The values in Table A3 represent the minimum pressures to be quoted where a multiple meter point mains extension or single service connection is subject to network analysis as part of the quotation process.

7. DESIGN OF SERVICES

7.1 Standard tables

Wherever possible, services should be sized in accordance with standard tables within this specification. Standard sizes do not preclude the reduction of nominal diameter for pipework and fittings at the service termination location. In these circumstances, it is not necessary to check the design in Toolbox.

All services should be designed in accordance with Section 11. Pipe codes used in design tools should be in accordance with Section 13.

Additional or simplified requirements for specific areas of service design activities are outlined in the following sub sections.

7.2 New LP services

Standard service sizes, for the range <=1083kW and <=63m, must be quoted in accordance with the values shown in Section 10 - Table A5.

Above ground domestic service laterals <=15m must be sized in accordance with Section 10 - Table A6.

7.3 Increased loads to existing LP services

Existing services, subject to a load increase, are permitted a maximum pressure drop of up to 5mbar where sufficient mains pressure is available.

The total revised load should be assessed against Table A2 to determine any requirement for network analysis.

To assess whether a standard mains pressure can be utilised, reference must be made to Section 10 - Table A2, by comparing the total revised load (new plus existing) against mains size. If the total revised load request is <=1083kW and the length is <=50m, Section 10 - Table A8 should be used to determine if the existing service is to be replaced.

7.4 Replacement of services not subject to a load increase

Where an existing service is identified for replacement due to condition or policy, the process defined within the relevant mains and service laying procedure should be used to identify the size of pipe to be installed.

7.5 New MP services

Standard service sizes, in the range <=1083kW and <=63m, must be sized in accordance with Table A7.

8. DESIGN OF MAINS

8.1 Mains design

Mains shall be designed in accordance with Section 11, and the pipe code table used in design tools must be in accordance with Section 13. Additional or simplified requirements for specific areas of mains design activities are outlined in the following sections.

8.2 Standard LP/MP mains connection design sizes for UIP/GT connections

Where the connected load is <10,833kW, the standard connection (corresponding to the load size) must be found in Section 10 - Table A4.

8.3 Approved mains connections for all pressure tiers and work types

Manifold connections must not be used. Mains connections to an existing system should use an SGN approved-manufacturer's standard tee or fitting, see **GIS/PL2** for further details. The method for connection must be in accordance with Tables A9 and A10.

8.4 Criteria for 'Fastrack' application

New load requests may bypass the formal quotation and acceptance process should they meet the following criteria:

- New typical load requests that fall within the blue boundary section of Table A2.
- New typical load requests that fall within Table A1.
- New typical load requests that fall outside the remit of Tables A1 and A2 where a pre-acceptance enquiry has been submitted and has identified no need for network reinforcement.
- Load decrease CSEP requests.
- Biomethane Injection projects*.

*Subject to issuance of a prerequisite SGN Capacity Study. See 'SGN Briefing Note 10' for further guidance on the Fastrack process.

9. NON-TYPICAL DEMANDS

A non-typical demand is a demand with a non-typical seasonal and/or daily profile. A typical demand is therefore one considered to be ‘temperature sensitive’, i.e. Domestic customers, as such any demand that does not follow a predictable, modulating pattern in line with domestic usage is considered Non-typical.

Customers using compressors or boosters also fall into this category.

New load requests where the demand is identified as being Non-typical cannot utilise the Fastrack process, even when if they fall within the guaranteed pressure tables.

It is important that sufficient information is gathered from the customer to properly assess the impact of non-typical demands on the upstream and downstream system network.

Network analysis, including the use of such tools as Compass, where necessary, must be carried out. Reference should be made to Section 12.

See ‘SGN Third Party Connections Briefing Note 17’ for further guidance on Non-typical demand classification.

10. STANDARD DESIGN TABLES

10.1 Network analysis threshold for medium pressure systems

Table A1 applies to multiple and single premises load enquiries proposed to be supplied from Medium Pressure systems. Using the diameter of the parent main, compare the maximum permissible demand (PID) with the requested hourly flow (SHQ). Where the SHQ does not exceed the indicated value, no additional network analysis is required & the design work should progress.

The Pressure Tier of the MP system should be identified before using Table A1.

Nominal Pipe Diameter	**Maximum Demand (kW/scmh) [PID for services / Pk6 for multiple premise sites)**	
	MP: DMP ≤65mb	**MP: DMP >65mb**
≤ 2" / ≤ 50mm metallic	≤ 110 / 10	≤ 220 / 20
≤ 63mm / ≤ 2" PE		
> 2" - ≤ 4" metallic	≤ 275 / 25	≤ 433 / 40
>50mm- ≤125mm metallic		
> 63 - ≤125mm PE		
> 2" - ≤ 4" PE		
> 4" - ≤ 6" metallic	≤541 / 50	≤ 920 / 85
>100 - ≤150mm metallic		
>125-≤180mm PE		
> 4" - ≤ 6" PE		
> 6" - ≤ 8" metallic	≤ 1300 / 120	≤ 1408 / 130
> 150 - ≤ 200mm metallic		
> 180mm - ≤250mm PE		
> 6" - ≤ 8" PE		
> 8” - ≤ 12” metallic	≤ 1733 / 160	≤ 1733/ 160
> 200 - ≤300mm metallic		
> 250mm - ≤ 355mm PE		
> 8" - ≤ 12" PE		
> 12" / 300mm metallic	≤ 2167 / 200	≤ 2167 / 200
> 355mm / >12" PE		

Table A1: Network Analysis Threshold Table for Medium Pressure Systems

Table A1 should not be used where a new demand is considered Non-typical and full Network Analysis must be undertaken.

Where the requested SHQ exceeds the PID value shown on Table A1, but ≤1733kW/160scmh*, network analysis will not be required at the quotation stage. However, such loads will be subject to a Post-Acceptance capacity check (by SGN) to ensure SOS (*Not applicable to nominal pipe diameters >8”/250mm PE).

10.2 Capacity rights and connection point pressures for supplies from the Low-Pressure system

Table A2 below provides the minimum pressure to be supplied where a requested new load (Max. permissible demand) is proposed to be taken from the low-pressure system, compared to the existing parent main diameter (nominal diameter). Typical demand and main combinations that fall within the solid blue boundary line do not warrant full pre-acceptance Network Analysis and can utilise the Fastrack process.

Max. Permissible Demand (kW/ scmh) / Nominal Diameter	≤65 /≤6	≤173 / ≤16	≤433 / ≤40	≤920 / ≤85	≤1733 /≤160	≤2167 /≤200	≤3250 /≤300	≤4333 / ≤400	≤5416 / ≤500	>5416 / >500
≤ 2" / ≤ 50mm metallic	23	23	23	23	23	25	26	26	26	Supply pressure to be agreed by negotiation with the customer (or their representative). The values in the previous column must be used as a start point and the agreed values must allow the efficient development of the overall system.
≤ 63mm / ≤ 2" PE										
> 2" - ≤ 4" metallic	23	23	24	24	24	25	26	26	26	
>50mm - ≤100mm metallic										
> 63 - 125mm PE										
> 2" – 4" PE										
> 4" - ≤ 6" metallic	23	23	24	25	25	25	26	26	26	
>100 - ≤150mm metallic										
>125-≤180mm PE										
>4" - ≤6" PE										
> 6" - ≤ 8" metallic	23	23	24	25	25	25	26	26	26	
> 150 - ≤ 200mm metallic										
> 180mm - ≤250mm PE										
> 6" - ≤8" PE										
> 8" - ≤ 12" metallic	23	23	24	25	25	25	26	26	26	
> 200 - ≤ 300mm metallic										
> 250mm - ≤ 355mm PE										
> 8" - ≤ 12" PE										
> 12" / >300mm metallic	23	23	24	25	25	25	26	26	26	
> 355mm / >12" PE										

Table A2: Capacity Rights and Connection Point Pressures for Supplies from the Low-Pressure System

NOTES
(1) When considering discrete systems designed post December 1995, add 1.75mb to the stated values.
(2) Table A2 should not be used when designing a main to be laid from the parent main to the base of a riser, for that scenario see Section 11.13 and Table B4.

Loads that fall within the solid blue boundary in Table A2 are guaranteed capacity for all load types, excluding those considered Non-typical, see Section 9.

The pressures within the boundary define the standard connection point pressures to be quoted for multiple meter point requests.

For single or dual service connection pressures, see Section 6.6.

The cell pressures can be used as available pressure for new service designs ≥180mm diameter, (see note 2 within Table B1), and other service designs involving a mains element.

In the case of 'alternative to reinforcement' deep connection points, the minimum pressure relates to the pressure at the customer's (downstream) end of the system extension.

Non-typical loads and loads requested from the SIU's that fall within the solid bold blue boundary in Table A2 must be assessed using full Network Analysis and cannot follow the Fastrack process.

The values outside of the defined box in Table A2 provide the minimum supply pressure and the charging point pressure for multiple premises sites where reference to the analysis model identifies the indicated pressure is not available.

Those multiple premise demands that are outside of the defined solid bold blue boundary in Table A2 should be subjected to network analysis to identify the available pressure. The values in Table A2 will be the minimum supply pressure for this type of request where the analysis model shows the table cell pressure is not available.

Loads falling within the shaded cells will be subject to a post acceptance security of supply check.
For demands >5416kW / >500scmh the charging point pressure is 26mb.

Note: Where appropriate, SGN will identify instances and the circumstances, normally at post acceptance, where it may be preferable to re-negotiate the connection pressure provided. This may be to minimise reinforcement/connection costs, to remove the requirement for reinforcement and therefore reduce lead times associated with providing the connection, or to avoid the situation where the required pressure may dictate inflated network operating pressures in the future thereby having a detrimental impact on shrinkage and SGN's environmental footprint.

Requests for pressures higher than those quoted in Table A2 cannot follow the Fastrack process.

10.3 Connection point pressures for supplies from the Intermediate Pressure (IP) system

Where a connection is proposed onto SGN's Intermediate Pressure (IP) System, the following standard source pressures will apply:

Single Service connection	2760mb
Network Mains extension	3460mb

See Section 16 for Charging Point pressures for all pressure tiers (LP/MP/IP).

10.4 Connection point design pressure (loads <1733kW/160scmh) and minimum supply pressure for all MP mains extensions

The values within Table A3 represent the design pressure that should be used as the source pressure for the design of any connection that:

- Is for a load less than 160scmh, including services, that is not subject to network analysis.
- Provides the minimum design supply pressure from the SGN parent main for a mains system extension.

Pressure / Tier (DMP)	Maximum Operating Pressure (MOP)	Min. Parent Main Supply Pressure	Design Minimum Mains Pressure	Max Service Pressure Drop
MP = 280mb	2000mb	450mb	350mb	70mb
MP = 180mb	1600mb	350mb	250mb	70mb
MP = 105mb	1100mb	240mb	140mb	35mb
MP = 65mb	250mb	150mb	100mb	35mb
MP = 35mb	185mb	95mb	70mb	35mb

Table A3: Design Pressure for MP extensions

The system Design Minimum Pressure (DMP) is dependent on the MP tier. The relevant tier information will be made available by SGN.

The Minimum Parent Main Supply Pressures will be provided as the source pressure for the design of mains extensions. However, they do NOT infer actual mains pressures to be maintained, i.e. SGN may choose, post-acceptance, to modify the pipe(s) to meet the operational requirements of the system and will fund any subsequent changes.

The Design Minimum Mains Pressures will be provided as the source pressure for the design of new services.

When dealing with a UIP submission, any mains that SGN is requested to adopt must be designed to ensure the minimum mains pressure, as stated in the middle column, is maintained. Similarly, any service that SGN is to take ownership of should be designed in accordance with the maximum pressure drops shown within Table B1 and which have been included for easy reference in the right-hand column above.

The pressures represent the minimum to be available during peak demand conditions. The pressure may be less than that indicated at off-peak times. The minimum pressure will be identified for inclusion within the quotations document.

The minimum parent main supply pressures will also be the minimum design pressures to be provided.

The cell pressures represent the minimum parent main design pressures to be provided for mains extensions, and/or used for charging point purposes for all load sizes, where reference to the analysis model identifies the indicated pressure is not available.
Charging point pressures for services are taken as the design minimum mains pressure.

SGN may choose to upsize mains to be laid, and/or takes ownership, to provide enhanced mains extremity pressures (at SGN cost) in accordance with the current agreement.

Post acceptance SOS checks must be carried when the load/mains size combination would require network analysis in accordance with Table A1.

Requests for pressures higher than those quote in Table A3 cannot follow the Fastrack process.

10.5 Standard connection diameter for multiple premises sites (final connection for GT/UIP requests)

SGN will provide the default connection pipe diameter in Table A4 to supply multiple premises sites for the indicated maximum demand.

Max. Permissible Demand (kW) / (scmh)	LP: Diameter (mm)	MP: DMP ≤65mb Diameter (mm)	MP: DMP ≤105mb Diameter (mm)	MP: DMP >105mb Diameter (mm)
<=325 / <=30	63	63	63	63
<=758 / <=70	90	63	63	63
<=1083/ <=100	90	63	63	63
<=1733 / <=160	125	90	63	63
<=2167 / <=200	125	90	90	90
<=3250 / <=300	125	90	90	90
<=4333 / <=400	180	125	90	90
<=5416 / <=500	180	125	90	90
<=10833 /<=1000	180	125	125	125
>10833 / >1000	By Negotiation			

Table A4: Standard Connection Diameter for Multiple Premises Sites (Final connection for GT/UIP requests)

Table A4 values are the diameters to be used for quotation unless requested otherwise (note the value shown is the nominal diameter and may be subject to substitution with a material of similar effective diameter).

Diameters greater than the value shown, may be provided on request, subject to additional charge.

The table values are the minimum values that will be accepted as a UIP design. See Tables A9 and A10 for the list of approved connection types that must be used.

10.6 Standard service designs for LP networks

Allowable Length / PID	≤ 10m	≤ 15m	≤ 23m	≤ 30m	≤ 50m	≤ 63m
≤ 32.5kW	32mm	32mm	32mm	32mm	32mm	32mm
≤ 65kW (U6)	32mm	32mm	32mm	32mm	63mm	63mm
≤ 173kW (U16)	63mm	63mm	63mm	63mm	63mm	63mm
≤ 275kW (U25)	63mm	63mm	63mm	63mm	63mm	63mm
≤ 433kW (U40)	63mm	63mm	63mm	90mm	90mm	90mm
≤ 693kW (U65)	90mm	90mm	90mm	90mm	90mm	90mm
≤ 1083kW (U100)	90mm	90mm	90mm	90mm	125mm	125mm

Table A5: Standard service designs for LP networks

NOTES:

(1) The values indicated can be replaced by the equivalent nominal diameter for an alternative material.

(2) An allowance has been made for the presence of standard connection & termination fittings.

Table A5 should be used for service connections to LP mains only, and assumes the use of a standard manufacturer's connection (see Tables A9 & A10)

The lengths quoted represent the allowable planned length from parent main to meter point.

New UIP requests outside the remit of Table A5 should utilise bespoke design tools to warrant proposals conform to other parameters from Section 11.

10.7 Above ground standard service (laterals) to domestic premises (LP only)

Length (m) / PID (kWh)	≤ 7m	≤ 15m
≤ 32.5kW	¾"ST	¾"ST
≤ 65kW (U6)	¾"ST	1"ST

Table A6: Above Ground Standard Service (Laterals) to Domestic Premises (LP only)

To be used when designing above ground service (lateral) to be connected to an above ground riser. Individual services (laterals) with a nominated demand in excess of 6scmh should be designed in accordance with the process defined within Section 11, taking account of the individual fittings to be used.

The lengths indicated represent the allowable plan length from parent riser to meter point. Such horizontal above ground pipes in excess of the lengths indicated should only be installed with the Approval of the Responsible Person.

10.8 Default service design for all MP systems

Length (m) / PID (kW / scmh)	≤63m
≤173 / ≤16	32mm
≤1083/ ≤100	63mm

Table A7: Default service design for all MP systems

Services more than 63m in length should be designed in accordance with the process in Section 11.

Service excess flow valves should be fitted on all MP domestic services where the PID is ≤6scmh (65kW). Whilst there is no requirement for an additional service isolation valve, all other MP services should be provided with service isolation valves.

Table A7 applies to all SGN Medium Pressure tiers as outlined in Table A3.

10.9 Maximum length of pipe to be retained where a large pressure drop (>2mb) is available to be used

Maximum pressure drop	**≤ 3mb**			**≤ 4mb**			**≤ 5mb**		
Length (m) / PID	**<=10m**	**<=25m**	**<=50m**	**<=10m**	**<=25m**	**<=50m**	**<=10m**	**<=25m**	**<=50m**
<=32.5kW	20mm	25mm	25mm	20mm	25mm	25mm	20mm	25mm	25mm
<=65kW(U6)	25mm	32mm	32mm	25mm	32mm	32mm	25mm	32mm	32mm
<=173kW (U16)	63mm	63mm	63mm	63mm	63mm	63mm	63mm	63mm	63mm
<=433kW (U40)	63mm	63mm	63mm	63mm	63mm	63mm	63mm	63mm	63mm
<=693kW (U65)	63mm	90mm	90mm	63mm	63mm	90mm	63mm	63mm	90mm
<=1083kW (U100)	90mm	90mm	90mm	90mm	90mm	90mm	90mm	90mm	90mm

Table A8: Maximum length of pipe to be retained where a large pressure drop (>2mb) is available to be used

Note: The values indicated can be replaced by the equivalent nominal diameter, e.g. 63mm PE is equivalent to 2" metallic.

Table A8 should be used to evaluate the design or retention of LP services in conjunction with Table A2 to avoid the need for Network Analysis to evaluate new demands where:

- It is proposed to retain an existing service pipe subject to an increased demand.
- It is proposed to install a new service pipe with a pressure drop >2mb (where original design results in a pipe of >=6" / 180mm).
- The load is of a 'typical profile'.

The minimum service diameter for all new services (including replacement of existing services where insertion cannot be used) is 32mm, irrespective of the pressure drop used for its design. The use of a smaller pipe for new services is prohibited.

10.10 Approved connections for PE mains to PE mains

Where there is more than one way of installing an approved type of connection, the least cost method will form the basis of any quotation. Only standard manufacturer's proprietary fittings should be used to provide connection to SGN's systems, i.e. the use of multiple fittings to provide adequate capacity is prohibited.

Only approved fittings should be used in accordance with the current Gas Industry Standards, i.e. **GIS/PL2.**

<table>
<tr><th>Parent / Connection</th><th>63mm</th><th>90mm</th><th>125mm</th><th>180mm</th><th>250mm</th><th>315mm</th><th>>315mm</th></tr>
<tr><td>63mm</td><td colspan="6">63mm top outlet 'service' tee (*)
– a high volume tee should be used to connect along the length of a pipe & a coupler used to connect to the end of a pipe for continuations</td></tr>
<tr><td>90mm</td><td rowspan="6">63 x 63mm Cut out Tee & Reducers</td><td>Cut out tee</td><td colspan="5">Branch Saddle Connection</td></tr>
<tr><td>125mm</td><td rowspan="5">90 x 90 Cut out Tee & reducer(s)</td><td>Cut out tee</td><td colspan="4">Branch Saddle Connection</td></tr>
<tr><td>180mm</td><td rowspan="4">125 x 125 Cut out Tee & reducer(s)</td><td>Cut out tee</td><td colspan="3">Branch Saddle Connection</td></tr>
<tr><td>250mm</td><td rowspan="3">180 x 180 Cut out Tee & reducer(s)</td><td>Cut out tee</td><td colspan="2">Branch Saddle Connection</td></tr>
<tr><td>315mm</td><td rowspan="2">250 x 250 Cut out Tee & reducer(s)</td><td>Cut out tee</td><td>Cut out equal tee</td></tr>
<tr><td>>315mm</td><td>315 x 315 Cut out Tee & reducer</td><td>Cut out tee</td></tr>
</table>

Table A9: Approved connections for PE mains to PE mains

(*) Limit to 433KWh for LP mains, refer 12.5.2.

10.11 Approved connections for PE / Metallic to Metallic mains

<table>
<tr><th>Parent / Connection</th><th>2"</th><th>3"</th><th>4"</th><th>6"</th><th>8"</th><th>10"</th><th>>10"</th></tr>
<tr><td><=63mm / <=2"</td><td colspan="3">Encirclement tee/drilling saddle</td><td colspan="4">63mm or 2“Metallic Top Tee</td></tr>
<tr><td><=90mm / <=3"</td><td rowspan="6">2" x 2" Encirclement tee & reducer(s)</td><td colspan="6">Encirclement Tee & reducer(s)</td></tr>
<tr><td><=125mm / <=4"</td><td rowspan="5">3" x 3" Encirclement tee & reducer(s)</td><td colspan="5">Encirclement Tee & reducer(s)</td></tr>
<tr><td><=180mm / <=6"</td><td rowspan="4">4" x 4" Encirclement tee & reducer(s)</td><td colspan="4">Encirclement Tee & reducer(s)</td></tr>
<tr><td><=250mm / <=8"</td><td rowspan="3">6" x 6" Encirclement tee & reducer(s)</td><td colspan="3">Encirclement Tee & reducer(s)</td></tr>
<tr><td><=315mm / <=10"</td><td rowspan="2">8" x 8" Encirclement tee & reducer(s)</td><td colspan="2">Encirclement Tee & reducer(s)</td></tr>
<tr><td>>315mm / >10"</td><td>10” x 10” Encirclement tee & reducer(s)</td><td>Encirclement Tee & reducer(s)</td></tr>
</table>

Table A10: Approved connections for PE / Metallic to Metallic mains

When considering the provision of a connection for a pipe >16" nominal diameter, a risk assessment should be undertaken. Further information is available from SGN.

11. SPECIFICATION FOR THE DESIGN OF PIPES & GENERAL REQUIREMENTS

Wherever practicable, the design of a new pipe should be carried out using the relevant ‘Standard Design Tables’ from Section 10. This will avoid carrying out a bespoke design if the demand and the mains system support the use of a standard design.

This section describes the rules to be used where this is not appropriate. The responsible person should ensure that all pipe design, or design evaluation, is carried out with regard to the requirements of SGN/PM/NP/16, SGN/PM/NP/18, SGN/PM/NP/4 and SGN’s Connections Policy.

Reference should be made to the SGN/SP/NP/10 to identify the instances where a supply pipe should be considered to comprise a main, a service or a riser. Once identified, the sections below should be used to design the pipe in an appropriate manner.

The following rules assume that no reinforcement of the existing system is required for the Post-Acceptance design. In cases where reinforcement is required, reference should be made to Section 14 – ‘Assessing the Impact with Reference to the Network Analysis Model’.

11.1 General design considerations

- **Main, Riser and Service** – For definition of a main, riser or service refer to SGN/SP/NP/10: Specification for Defining Pipes as Mains, Services or Risers.
- **Length** - The length of the pipe should be identified using SGN's GIS systems or the customer's site plan.
- **Velocity** - For all new **services** operating at pressures not exceeding 7 bar, the design gas velocity shall not exceed **15m/s.** For all new **mains** operating at pressures not exceeding 7 bar, the design gas velocity shall not exceed **40m/s.**
- **Pipe Code Table** - The pipe code tables given in Section 13 should be used for the design of all new system extensions to SGN's networks when incorporating existing, or non-standard, pipes within a new design.
- **Route planning** - the route should be planned in accordance with the recommendations and guidance given in IGEM/TD/3, IGEM/TD/4, IGEM/GL/1 and IGEM/GL/2.
- **Meter locations and specifications of housing** – Meter housing and locations should be in accordance with IGEM/GM/8 (Parts 1-5), IGEM/GM/7 (A & B), IGEM/GM/6, IGEM/SR/25 and SGN/SP/SER/8.
- **Note**: In the case of domestic premises, it is SGN's policy to terminate services at meter positions in external meter boxes on the front face of a building or not more than 2m up the gable; or to internal meter positions within 2m of the point of entry.

  See SGN Third Party Connections Briefing Note 16 for further guidance on preferred meter locations.
- **Non-typical demands** - Reference should be made to Section 12 for details of the design requirements for these demands.

  See SGN Briefing Note 17 for further guidance on Non-typical demand classifications.

11.2 Maximum design pressure drop

The following values should be used for the design of all services and must not be exceeded.

Description / Pressure Tier	Description	Maximum design pressure drop
LP (DMP <=19mb)	New	2mb or <=5mb[1,2]
	Non-Insertion replacement	2mb or <=5mb[1,2]
	Insertion replacement	<=5mb[3]
MP (DMP <=105mb)	All	35mb
MP (DMP >105mb)	All	70mb
IP	All	20% of available pressure drop (capped minimum of 140mb)

Table B1: Maximum Design Pressure Drop

The design shall include an allowance for connection & termination fittings and must remain within the defined maximum pressure drop value.

(1) Where the new service contains a pipe ≥180mm / 6" (nominal) diameter & reference analysis confirms the design pressure to be used.
(2) For loads that fall within the Scope of Table A2, the assumed parent mains pressure will be taken from the appropriate cell.
(3) Where the parent main pressure has been confirmed as acceptable.

11.3 Design of mains (pipe and fittings)

The impact of minor fittings (connections, bends, valves etc.) should be managed within the design tool through a reduction in the hydraulic efficiency of the pipe system, so no allowance should be made in the design for any fittings associated with the mains connection. However, if the Responsible Person directs that a non-standard connection (less than the nominal diameter of the extension) be used, the fitting (in the form of an extension of the pipe equivalent to the length shown within Tables B2 & B3) should be added to the network model.

The minimum supply pressure (defined within Table A2), for multiple premises sites, is the pressure to be supplied at the outlet of the SGN system, i.e. at the outlet face of the valve or "pup" fitting provided to allow connection to the main. The pressure loss across this fitting should not exceed more than 10% of the available pressure for the design of the system extension.

11.4 Mains extension designs arising from request for supply to individual premises

11.4.1 Pre-acceptance design

For a single premise design where a main is to be provided, the main should be designed using the pressure indicated within Table A2 or A3 as the source pressure. However, where a CSEP connection does not incorporate a mains extension, only 'service pressure' will be offered for all pressure tiers.

If Table A2 or A3 cannot be used, reference should be made to Network Analysis to identify the allowable pressure drop.

The pipe should be designed as a single diameter and should not be less than 63mm PE in diameter (or equivalent for steel pipes) where there is potential for additional connections being taken, either by the consumer or another party.

11.4.2 Post-acceptance design

Upon receipt of an Acceptance, reference should be made to Network Analysis to identify the allowable pressure drop. The "Industry least cost" solution should be identified and installed; the main should not be less than 63mm PE in diameter (or equivalent for steel pipes) where there is potential for additional connections being taken, either by the consumer or another party.

Where a Condition 16 (C16) demand is required, the pressure to be supplied to the future connection point of this potential demand should be identified – this may be part way along, or at the end of the main. See Table A2 or A3 for the required pressure at that future connection point for LP and MP/IP systems.

11.5 Design of mains extensions to sites with multiple premises

11.5.1 Demands

Post acceptance, the mains should be designed to supply the requested demand and any C16 potential demand identified by SGN, see Section 12.4.2.

11.6 Services

11.5.2 Pipe and Fittings

An allowance should be made in the design, for all fittings used as part of the service installation. This should be done using the equivalent length of pipe associated with each fitting component, as shown within Tables B2 and B3, for any pressure tier. The calculations should be carried out to ensure that pressure drop within the pipe does not exceed the maximum value shown in Table B1.

Notwithstanding the above, 63mm tapping tees connected to low pressure PE mains should be limited to 433 KWh.

11.5.3 Design new service:

- **Pressure:** The service should be designed using the pressure drop shown in Table B1 and minimum pressure associated with the relevant pressure tier.
- **Pipe Diameter and Fittings:** The minimum diameter used for all new services is 32mm PE or equivalent. Figure 1 details the rules when a composite pipe should be considered. Services up to 63m long should be designed as a single diameter.

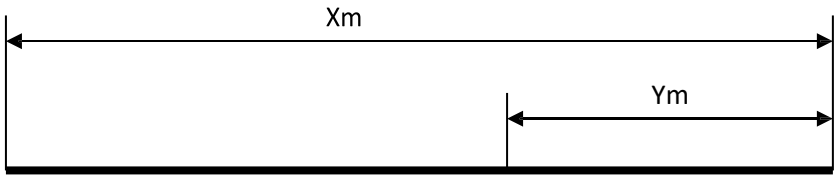


Figure 1: Design single diameter or composite pipe

Composite pipes should be designed using two diameters only, with the larger diameter associated with the connection and the smaller as the termination pipe, taking account of losses arising from the equivalent length of fittings. The equivalent lengths for fittings are to be used within composite pipe calculations are defined within Section 11 - Tables B2 and B3.

Length	Criteria	Service configuration
Xm ≤63m	N/A	Single Diameter
Xm >63m	Where Y ≤30% X	Single Diameter Pipe
	Where Y >30% X	Composite Diameter

Services should not be designed as a composite service where the length of one part is very small (<30% of the total length). Consideration can still be given to reduce the termination down one size.

For example, on domestic installations, it is anticipated a ¾" x 25mm house entry tee will normally be used; however, this change in size should not be considered to constitute a composite pipe.

11.5.4 Remote pressure reduction

Services from MP and IP mains may be designed with the pressure reduction unit remote from the meter unit.

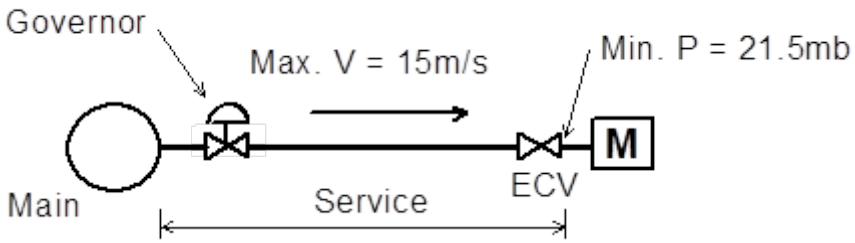


Figure 2: Service with Remote Pressure Reduction

Where this is the case, the full pressure drop between the outlet of the pressure reduction unit and the normal pressure required at the ECV should be used in the service design. In such installations, the pressure drop associated with the LP service **may** exceed the standard value shown within Table B1, and the limiting design criterion may be the gas velocity (consistent with Table A5 minimum service diameter to be used will be 32mm).

11.7 Equivalent lengths of standard service components

Fitting description	Pipe Diameter								
	<=32mm or <= 1" St	<=63mm or <=2" St	<=90mm or <=3" St	<=125mm or <=4" St	<=180mm or <=6" St	<=250mm or <=8" St	<=315mm or <=10" St	<=355mm or <=12" St	>355m m or >12" St
Elbow	0.5m	1m	1.5m	2.5m	3.5m	5.0m	7.0m	10.5m	14.5m
Tee - flow straight through	0.5m	1m	1.5m	2.5m	3.5m	5.0m	7.0m	10.5m	14.5m
Tee - flow through branch	1.5m	3m	4.5m	7.5m	10.5m	14.5m	19.0m	25.0m	31.0m
Swept bend	0.3m	0.45m	n/a	n/a	n/a	n/a	n/a	n/a	n/a
All valves	0.45m	0.68m	1.0m	1.8m	2.7m	4.2m	6.0m	8.0m	10.5m
Meter box entries	0.5m								

Table B2: Equivalent lengths of standard service components

11.8 Service components - specific fittings

Description of connection fitting	Equivalent Length	Equivalent Diameter
32 Tee off any PE Diameter	4.0m	32mm PE
63 Tee off any PE Diameter (LP mains)	12.0m	63mm PE
63 Tee off any PE Diameter (MP mains)	30.0m	63mm PE
1½" x 2" Flex Top Tee	4.0m	1½" Steel
1" Metallic Top Tee	4.0m	1" Steel
Reduced branch tee	Length of "Tee - flow through branch"	Use diameter of Branch pipe

Table B3: Service Components – specific fittings

11.9 Increase demand in existing service

For the purposes of this document, an existing service should be assumed to exist where there is a live service identifiable in SGN's Asset Database.

Where there is no record of an existing "live" service, unless a site visit identifies otherwise, it should be assumed that any existing pipe is not suitable for use to transport gas. In such circumstances, a new service design should be undertaken.

11.10 Evaluation of the configuration of an existing service

Where possible, the configuration (length and diameter) of the service should be identified from Network "as laid" records.

In the absence of this information, it should be assumed that the service is constructed in one pipe diameter, with a standard connection and termination configuration.

11.11 Assessment of Existing Design

The connection and termination fittings should be taken into account when calculating the pressure drop associated with the total increased demand.

Where the identified pressure drop exceeds that given for the relevant pressure tier in Table B1, the existing service should be replaced, with the service being designed to meet this defined pressure drop limit.

11.12 Velocity

Following an increase in demand, an existing service should not be replaced because of the maximum velocity being exceeded.

11.13 Riser design and premises with banks of meters

11.13.1 Pressure

The pressure at the extremity of a mains riser should be the same as the system minimum mains design pressure.

11.14 Design of riser and associated approach main

11.14.1 Designs connecting to LP mains

The approach main and above ground riser should be designed as a single unit and be based on the available pressure drop in the parent main or, where appropriate, the standard pressure taken from Table A2.

11.14.2 Designs connecting to MP or IP mains

Approach mains should be designed as a single unit using the available pressure drop.

The available pressure drop should be the difference between the outlet of the pressure reduction unit and the minimum pressure at the extremity of the riser.

11.14.3 Fittings

No allowance should be made in the design of the mains riser or the approach main for the presence of fittings.

11.14.4 Lateral design

Where the use of Table A6 is not possible (for example, the demand or length exceeds the values) individual laterals should be designed using the service calculator, with a maximum pressure drop of 2mbar. Laterals should be designed as single diameter pipes, with an allowance made for the presence of fittings.

11.15 Design of above ground rails (also known as Above Ground Manifolds)

Table B4 should be used for the design of single column above ground risers, when used with standard design above ground service laterals. It should also be used for the design of manifolds blocks of flats with ground floor banks of meters.

Max design Demand/length	<10m	<15m	<23m	<30m	<50m

<65kwh	32mm / 1"ST		32mm/ 1"ST	32mm / 1"ST	40mm/ 1 ¼"ST
<95kwh	32mm / 1"ST		32mm / 1"ST	40mm/ 1 ¼ "ST	40mm/ 1 ¼ "ST
<135kwh	32mm/ 1"ST	40mm/ 1 ¼" ST	40mm/ 1 ¼ "ST	40mm/ 1 ¼ "ST	40mm/ 1 ¼ "ST
<195kWh	40mm / 1 ¼" ST		63mm/ 1 ¼ "ST	63mm/ 1 ½ "ST	63mm/ 1 ½ "ST
<273kWh	63mm/ 1 ¼ "ST	63mm/ 1 ½ "ST	63mm/ 1 ½ "ST	63mm/ 2"ST	63mm/2" ST
<400kWh	63mm/ 1 ½" ST	63mm/ 2"ST	63mm /2"ST	63mm /2"ST	63mm /2"ST
<450kWh	63mm /2"ST		63mm / 2"ST	63mm /2"ST	>63mm / >2"ST
≥450kWh	Bespoke Design				

Table B4: Standard designs for single column risers and manifolds

- Table B4 should be used to design single column above ground risers and multiple, above ground manifolds connected to LP mains.
- Assumed that the nominal mains connection fitting is not less than the downstream pipe.
- Subject to a minimum mains diameter of 63mm PE where there is potential for additional connections being taken, either by the consumer or another party.
- The lengths indicated represent the total length from parent main to end of the "riser", where the mix of below/above ground pipe work is not considered significant.
- The above table is to be used or an alternative bespoke solution can be designed in accordance with Section 11.14.1.

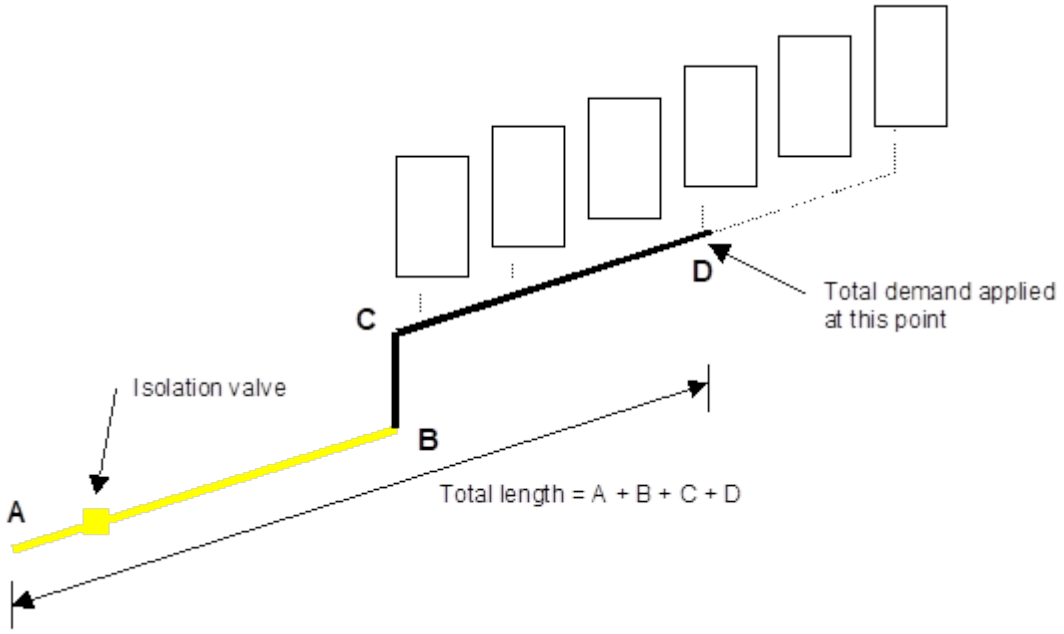


Figure 3: LP above ground rail, meters at separate locations– typical configuration

Service laterals should be designed in accordance with the requirements of Table A6.

11.15.1 Bespoke Design

Where it is not possible to design the rail using this approach, it should be designed in accordance with Section 11.14.1.

11.16 Design of connections to SGN's parent main

Refer to Tables A9 and A10.

Where a GT has stipulated a connection diameter less than that given in Table A4, the GT should be asked to confirm the requirement before a quotation is issued.

Where a UIP indicates a diameter less than the value within the Tables, the design should be evaluated to confirm they are suitable and should be rejected where appropriate. The Responsible Person should ensure that C16 demands are taken into account before confirming that connection should progress.

12. EVALUATION & DESIGN OF CONNECTIONS TO NON-TYPICAL DEMANDS

Where necessary, the relevant demand profile / gas use information should be provided under the Business Rules to allow the provision of a practical design solution. Where, at the outset of the design process this information is incomplete, a number of simplifying assumptions may be applied resulting in a sub-optimal design solution and additional assessment as the type and nature of the installation becomes clear.

The information that is required is shown in Tables C1 and C2.

The details in this table represent the basis for discussion with the end-user or their representative third party.

To identify the proposed profile of gas use, it is necessary to understand the time(s) of day and year at which the gas demand is required and if the demand varies from this level at the other key times/conditions of the day and year.				
Please complete the following boxes as is appropriate for the demand.				
Period	Please indicate with a tick the times of the day and year when demand usage may occur			
	0600-1000	**1000-1600**	**1600-2000**	**2000-0600**
Beginning October – end March				
Beginning June – end August (Summer)				
Other periods of the year				

Table C1: Where a non-typical demand profile is identified

12.1 Where a compressor or booster is identified as being installed

Peak Instantaneous Demand to be compressed and the pressure required:	……kW/m³/hr			……mbar/bar
Compressor Types (Reciprocating/Fan/Screw/Booster/Other)	…… ……			
Number of Compressors/Boosters and the Peak Instantaneous Demand to each excluding standby:	No.:		Flow:	Plant 1 ……kW/m³/hr Plant 2…… kW/m³/hr Plant 3……kW/m³/hr
Time taken to achieve full load from start up	Time taken …… seconds			
Profile provided for non linear start up profile	Y/N/NA			
Number of burners to be installed?				
Will burners be operated in parallel?	Y/N/NA			
Typical burner stages	Startup / Pre-	Pilot fire	Low fire	High fire
Flow as % of burner's PID – burner 1				
Minimum time for each stage (s) – burner 1				
Flow as % of burner's PID – burner 2				
Minimum time for each stage (s) – burner 2				
Flow as % of burner's PID – burner 3				
Minimum time for each stage (s) – burner 3				

Table C2: Where a compressor or booster is identified as being installed

Where the customer has identified a non-typical demand, it should be assessed using Network Analysis and, where appropriate, SGN's design assessment tool 'CompAss' or approved equivalent.

The following description refers to the use of CompAss, but it is assumed that the same principle will be used where an equivalent and approved tool is used.

12.2 Assessment of individual non-typical demands

Where a demand is to be used at a specified off-peak period only, its impact should be assessed, using the relevant model, against the specified period. The limited period identified will be clearly stated on all quotations correspondence as a condition of supply.

For pressure managed networks, the impact should be assessed against the worst case scenario. This could be a period of the day/year when the system is operating at extremely low pressures. Any such assumptions require to be documented within the quotation paperwork. The design of the system extension should be on a similar basis. Refer Table C3.

Source Settings	Standard Conditions	Scale for Demand Types		
		Domestic	Commercial	Industrial
Winter Day	Peak Hour, Peak Day Pressure	100%	100%	100%
Winter Night	Minimum Hour, Peak Day Pressure	40%	40%	100%
Summer Day	Peak Hour, Minimum Day Pressure	20%	20%	100%
Summer Night	Minimum Hour, Minimum Day Pressure	10%	10%	100%

Table C3:Conditions to be modelled for non-typical off-peak demands on LP networks and direct fed MP demands

- The figures shown in this table shall be used to ensure consistent design output is provided. No additional demand modifications should be made to model demands being absent, or present, for the time the analysis being carried out.
- Commercial and Industrial gas usage patterns should be provided to SGN on the Table C1. Where such information is not available, SGN will assume demand as being constant throughout the year and across the day.
- For MP networks assume downstream demand is per the domestic tag for the design of single and composite pipes and mains, see Section 11.

12.3 Supplies to elevated pressure demands

Contact should be made with any consumers requesting an elevated pressure to identify when this pressure is required.

Where a specific period is specified, analysis should be undertaken to identify how it can be provided. Where the customer is not able to define a period the range of pressures associated with the point of connection should be identified using the settings shown in Table C3.

12.4 Supplies to CSEPs containing non-typical demands

Where a CSEP site includes a non-typical demand or a demand that has downstream compressor or booster or has requested specific off-peak pressures, the iGT should be requested to supply either:

- The demands it anticipates at the four standard conditions (see Table C3), or
- The demands it anticipates at specific times requested.

These demand levels should be applied to the relevant model(s) and the iGT provided with the resultant pressures at the CSEP connection.

Where an iGT is unable to specify the demand details, the demand types should be assumed to be non-temperature sensitive attached to a reciprocating compressor. The assumption must be stated within the quotation.

The demands should be scaled for the four standard conditions in accordance with the scaling factors given in Table C3.

Additionally, where an iGT has identified that the CSEP site includes a supply to a compressor or booster, the four standard pressures should be quoted. The iGT should be requested, as part of the Quotation, to confirm that the supply pressures are adequate, and the impact of the demand at the worst-case condition will not materially affect the parent system.

Where higher, peak or off-peak, pressures are required by the iGT than are indicated as being available, reinforcement should be evaluated in accordance with the requirements of this document and quoted in accordance with SGN's Charging Policy and Reinforcement Methodology.

The off-peak demand data should be retained for future modelling off-peak conditions and maintenance of the required pressures. The connection to the GT site should be designed in accordance with Section 11, or as requested by the GT.

12.5 Assessment of supplies using CompAss

Table C4 identifies the types of demand for which CompAss analysis is required

Demand type	'CompAss' assessment required
Non-typical consumption profile to individual demand	No
Non-typical consumption profile to CSEP	No
Downstream compression to individual demand	Yes
Downstream boosting to individual demand	Yes
Elevated pressure to individual demand	No
Downstream compression or boosting to CSEP	In agreement with GT

Table C4: Demand Types for use with CompAss

For connections to all pressure tiers below 7bar, when using CompAss, Network Analysis of the appropriate FY models and the relevant conditions should be undertaken to derive the steady state pressures available in the network.

Table C5 identifies the typical periods when the network is likely to experience maximum pressures under shut down conditions and minimum pressures under start up conditions. Reference to the table ensures that the level of demand which causes a rapid change and the service design will not give rise to unacceptable pressures in the network at these times.

Note: This list is not comprehensive, and the Competent Person should ensure that the "worst case" condition is understood and account taken of it, i.e. the condition may depend upon the network and the type of pressure management implemented.

Assessment	Type of network pressure management	Source Setting	Condition
Start-up	Fixed	Winter day	Peak hour, peak day pressure
	Clocked pressure	Winter day	Peak hour, peak day pressure
	Computer managed (closed loop control or pressure profiling)	Variable	Min hour, min day pressure
Shut down	Fixed	Summer night	Min hour, min day pressure
	Clocked pressure	Winter night	Min hour, peak day pressure
	Computer managed (closed loop control or pressure profiling)	Variable	Peak hour, peak day pressure

Table C5: Typical worst-case pressure conditions for assessment in CompAss

13.8.1 Demand factors for use in CompAss

To evaluate the impact of the specific compressor, the appropriate factor, as shown in Table C6 should be applied to the steady state flow when using CompAss:

Type	Factor
Booster	0
Reciprocating compressor	2.3
All other compressor types	1.0

Table C6: Factors for use in CompAss

Applying this factor takes account of the different ways that the equipment operates and ensures that its impact is known.

13.8.2 Pipes for input into CompAss

Wherever possible, the mains and service assessment option of CompAss should be used to ensure that the impact on the parent main is considered. This allows the maximum benefit of the dissipation of the wave to be assessed and lessens the distance to any critical point in the network where there is a constraint on the pressure required.

Rules for the ratio of service length to mains length are detailed below and should be applied unless specifically directed by the Responsible Person. Where the application of these rules is not possible, the impact on the service alone should be evaluated.

Ratio of Service Length to Mains Length
The following constraints should be taken into account when using CompAss to evaluate the impact of a compressor / booster:

- The maximum length of the main, upstream and downstream from the service, should be as far into the mains system as possible, but not greater than 10 times the length of the service.
- The minimum length of the main, upstream and downstream from the service, is not less than the length of the service.

- The cut off points for the main are a change in pipe diameter / material, or a pipe junction / connection.
- Where the service connection is supplied from a number of directions, the direction of flow should be taken to be the one with the greatest supply volume.
- Where the minimum length of the main, upstream or downstream from the service, is less than the length of the service, the CompAss "service" option should be used.
- Where the direction of the flow of gas to the service is from both directions, the CompAss "service" option should be used.

13.8.3 Transient pressure constraints for the assessment of non-typical demands

The maximum permissible transient pressure constraints, shown in Table C7, should not be exceeded when evaluating the impact of a non-typical demand. These values should be used within CompAss in the appropriate boxes.

<table>
<tr><th colspan="2">Constraint</th><th>Pressure Tier</th><th colspan="2">Pressure level</th></tr>
<tr><td rowspan="5">Transient pressure at connection point</td><td rowspan="3">Maximum Pressure</td><td>LP</td><td colspan="2">75mbar</td></tr>
<tr><td>MP</td><td colspan="2">2bar</td></tr>
<tr><td>IP</td><td colspan="2">7bar</td></tr>
<tr><td rowspan="3">Minimum Pressure</td><td>LP – highest of:</td><td>21mbar[1]</td><td>22.75mbar[2]</td></tr>
<tr><td>MP</td><td colspan="2" rowspan="2">Minimum 6-minute mains design pressure</td></tr>
<tr><td>IP</td></tr>
<tr><td rowspan="5">Transient pressure at meter point</td><td rowspan="3">Maximum Pressure</td><td>LP</td><td colspan="2">75mbar</td></tr>
<tr><td>MP</td><td colspan="2">2bar</td></tr>
<tr><td>IP</td><td colspan="2">7bar</td></tr>
<tr><td rowspan="3">Minimum Pressure</td><td>LP</td><td>19mbar[1]</td><td>20.75mbar[2]</td></tr>
<tr><td>MP</td><td colspan="2" rowspan="2">Minimum 6-minute system design pressure[3]</td></tr>
<tr><td>IP</td></tr>
</table>

Table C7: Transient Pressure for the Assessment of Non-Typical Demands

Notes:
1 – Systems designed pre 1997.
2 – Discrete systems designed post 1996.
3 – See Section 10.

13.8.4 Service design for supplies to demands requiring CompAss assessment

The following rules should be applied to the design of the service:

- The service should be designed using the PID identified by the customer and include the sum of any compressed demand plus all other demands.

- The diameter of the service must not exceed the diameter of the main from which the connection is taken.

Table C8 below represents the standard approved PE and steel design pipes associated with CompAss. Pipes other than those shown are not approved for use and must not be employed for quotations purposes. The equivalent nominal diameters in each row represent the maximum size of the parent main to which connection can be made, whilst meeting the requirements of this Instruction.

It has been assumed that only metric equivalent steel pipe will be used for service installation in the column showing the maximum permissible service diameter.

To ensure that the relevant non-PE diameters are clearly understood, reference may be made to the following table. Standard design pipe nominal diameters – default comparison.

PE (mm)	Metallic (Metric)	Metallic (Imperial)	Maximum service diameter PE / metallic
16	-	-	-
20	-	½"	-
25	20mm	¾"	-
32	25mm	1"	-
63	50mm	2"	63 / 50
90	80mm	3"	90 / 80
125	114mm	4"	125 / 114
180	168mm	6"	180 / 168
250	219mm	8"	250 / 219
315	273mm	10"	315 / 273
355	324mm	12"	355 / 324
400	406mm	15"	400 / 406
450	425mm	16"	450 / 425
500	440mm	17"	500 / 440
-	457mm	18"	457
-	508mm	20"	508
-	610mm	24"	610

Table C8 Standard pipe diameters – comparison table

The initial service should be designed using the service design criteria for the relevant pressure tier. The rules for the use of single and composite pipes should be adhered to, see Section 10.

The resulting service layout should be input into CompAss, together with the appropriate mains. Where the assessment of this design results in system constraints being violated, the diameter(s) of the service should be increased and the results reassessed.

Where modifying the service pipe diameter (bearing in mind the constraints on size of service) does not provide an acceptable solution, the provision of supply from a higher-pressure tier(s) should be considered. Where this is not possible, the customer should be advised that the supply cannot be provided without control being provided for the start-up and/or shut down of the compressor.

Reference should be made to Tables A9 and A10 for the details of the acceptable connection fittings and methods to be used.

Where changing the diameter of the service does not prevent in the system constraints being violated, and a feasible higher-pressure tier connection is not readily available, the "ramp rate" will be identified and the customer advised as one of the conditions of supply (the original service design (section 13.8.4) will be quoted when defining a "ramp rate").

The ramp rate is a coarse term to describe the cycle that starts with the booster turning on to pressurise the downstream pipework to 100% burner flow.

For conventional burner type appliances, e.g. boilers - there are typically 4 stages, booster on to pressurise pipework (<1% flow), burner start-up / pre-purge (<1% flow), burner pilot (<20% flow), burner low fire (<40% flow) and burner high fire (100% flow).

Each stage can be modelled in Compass providing the information is available. The ramp rate can be calculated from the formula:

T = 0.436*D

Where T is the ramp rate time (seconds) & D = upstream mains diameter (mm) For example, for a 250mm PE SDR17 pipe (ID 220.75mm), the Ramp Rate = 0.436*221 = 96 seconds.

Therefore, where a constant ramp rate is maintained for at least 96 seconds, no additional control is required to overcome the start-up/shut down affect.

Note: The "ramp rate" is, generally, only affective on compressors which are not feeding a burner, i.e. process loads / NGV filling stations etc. As a result, where this is not the case it will be necessary to take the connection from a higher-pressure tier.

"Snubbers" or other short length increases in pipe diameter should not be used to mitigate the impact of compressors or boosters, as they are not considered effective in dissipating the transient wave.

13.8.5 Quotation

All assumptions made during the assessment of non-typical demands will be recorded and made clear as caveats within the quotation to the customer.

13. SPECIFICATION FOR STANDARD PIPE CODE TABLE FOR NEW LAY PIPES

When undertaking the design of new system extensions, or the review of a 3rd party submission to be connected to SGN's system, the following pipe parameters should be used. As appropriate, SGN may allow supplementary pipes to be added to the list (i.e. where a UIP proposes to use a non-standard pipe size) which is considered suitable for adoption.

Nominal Diameter	Material	Internal Diameter	SDR	Pipe Efficiency Factor		
				Electro Fused & Butt Fused De-beaded	Butt Fused Non De- beaded 6	Butt Fused Non De- beaded 12
16	PE	11.15	7	0.97	-	-
20	PE	15.15	9	0.97	-	-
25	PE	20.15	11	0.97	-	-
32	PE	25.75	11	0.97	-	-
63	PE	50.9	11	0.97	-	-
63	PE	53.1	13.6	0.97	-	-
90	PE	79.2	17	0.97	-	-
90	PE	81.43	21	0.97	-	-
125	PE	101.3	11	0.97	0.89	0.93
125	PE	110.3	17	0.97	0.89	0.93
125	PE	113.09	21	0.97	0.89	0.93
180	PE	145.95	11	0.97	0.89	0.93
180	PE	158.75	17	0.97	0.89	0.93
180	PE	162.85	21	0.97	0.89	0.93
250	PE	202.95	11	0.97	0.89	0.93
250	PE	220.75	17	0.97	0.89	0.93
250	PE	226.2	21	0,97	0.89	0.93
315	PE	255.75	11	0.97	0.89	0.93
315	PE	278.25	17	0.97	0.89	0.93
315	PE	285.0	21	0.97	0.89	0.93
355	PE	288.1	11	0.97	0.89	0.93
355	PE	313.5	17	0.97	0.89	0.93
355	PE	321.19	21	0.97	0.89	0.93
400	PE	327.27	11	0.97	0.89	0.93
400	PE	353.2	17	0.97	0.89	0.93
400	PE	361.90	21	0.97	0.89	0.93
450	PE	407.14	21	0.97	0.89	0.93
500	PE	409.09	11	0.97	0.89	0.93
500	PE	441.7	17	0.97	0.89	0.93
500	PE	452.38	21	0.97	0.89	0.93

Table D1: PE Pipes

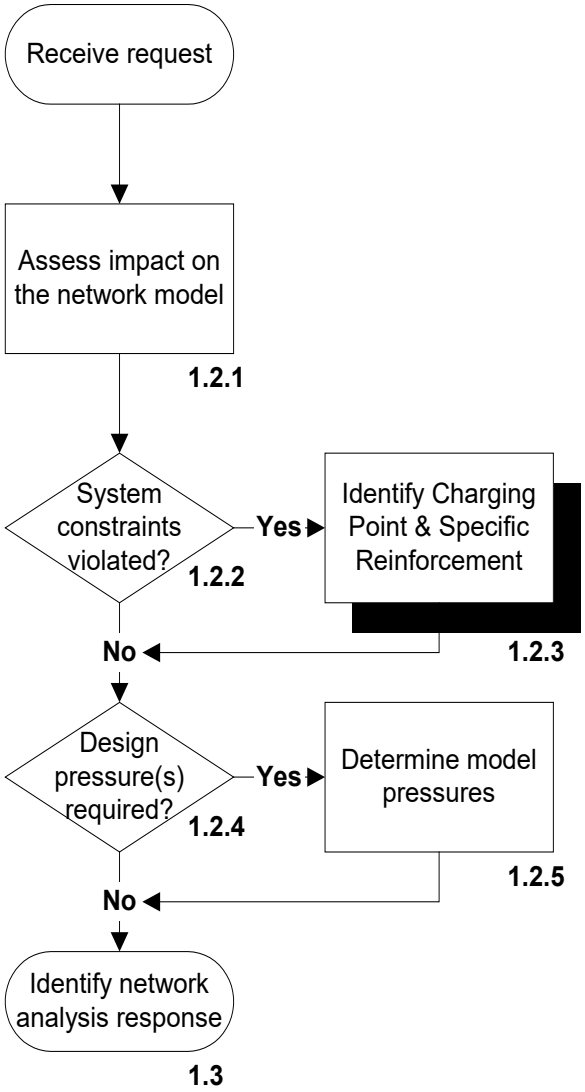
The above values are common for both the design of new, and review of existing, PE pipes.

Nominal Diameter	Material	Internal Diameter	Pipe Efficiency Factor		Mains or Service Design
			Fillet Welded Screwed	Butt Welded	
0.5	ST	19.93	0.86	-	S
0.75	ST	19.67	0.86	-	S
1	ST	26	0.86	-	M
1.25	ST	33.92	0.86	-	M
1.5	ST	38.67	0.86	-	M
2	ST	49.86	0.97	0.97	M
2.5	ST	65.43	-	0.97	M
3	ST	78.13	-	0.97	M
4	ST	103.53	-	0.97	M
6	ST	157.51	-	0.97	M
8	ST	206.38	-	0.97	M
10	ST	260.35	-	0.97	M
12	ST	311.15	-	0.97	M
16	ST	390.55	-	0.97	M
18	ST	441.35	-	0.97	M
20	ST	492.15	-	0.97	M
24	ST	593.75	-	0.97	M
30	ST	739.75	-	0.97	M
32	ST	793.75	-	0.97	M
36	ST	889	-	0.97	M
42	ST	1,066.8	-	0.97	M
48	ST	1,225.55	-	0.97	M

Table D2: Steel Pipes

14. ASSESSING THE IMPACT WITH REFERENCE TO THE NETWORK ANALYSIS MODEL

The following flow diagram and accompanying notes should be followed when the evaluation of the impact of a connection request requires Network Analysis.



14.1 General Requirements

The Connection Point shall lie on a main, to which connection is physically feasible (i.e. the pipe can be laid on the intended route) and conforms to the engineering requirements of this document.

Low pressure system extension design pressures, when quoted from models, should be rounded to the nearest 1mb, i.e. where the decimal part of the modelled pressure is equal to or greater than 0.5mb the pressure shall be rounded up and, conversely, where less than 0.5mb, rounded down.

For establishing specific reinforcement and charging point, the exact minimum pressures (non-rounded) stated within Tables A2 or A3 shall be achieved, see Section 14.2.

14.2 Assess impact on the network model

The network analysis models stated within SGN/PM/NP/18 and SGN/PM/NP/16 should be used when carrying out the impact evaluation.

In addition, replacements, and other financially approved projects (e.g. for committed potential demands) that are planned for installation prior to winter period following connection shall be included on the model.

The proposed physical solution shall be the one providing the **least cost of asset construction**. This need not necessarily be a Low Pressure solution and the Competent Person should review the options available and ensure that the correct one is selected.

The Responsible Person shall establish and maintain a peer review process to ensure that the appropriate physical solution is identified.

14.3 System Constraint Violated?

Identify where system constraints, on the relevant pressure tier, are violated. See SGN/PM/NP/18 for details of the system constraints.

14.4 Identify charging point and specific reinforcement

Where it is necessary to determine if any specific reinforcement is required for new load requests, the FY model for the winter following its proposed connection should be used. Where specific reinforcement is required a charging point analysis shall be undertaken in accordance with Section 14.7 (or the local guidance note for 'Determination of the Charging Point on LTS Networks' where it is believed that this will be on the LTS network).

The calculation and apportionment of customer costs shall be in accordance with SGN's Charging Policy.

The overall least cost of asset construction reinforcement to support the load should be identified. This may be:

- An upsizing of a more extensive scheme or a reduced part of that scheme to meet the wider network potential load growth identified.
- Additional capacity required solely to support the load enquiry but limited to that minimum necessary to maintain system constraints at FY (1).
- An alternative to reinforcement.

14.5 Design pressures required

Provision of design pressures is required under the following circumstances:

- Multiple / Individual meter point requests that fall outside the scope of standard tables.
- All installations involving connection to an IP system.

14.6 Determine model pressures

All approved, phased, or potential loads that are expected to become connected during the next five years should be included within the appropriate model(s), together with any future planned reinforcement and pipe/plant replacement necessary to ensure system constraints are maintained.

The source pressures should be optimised to ensure the system minimum system constraints are maintained.

The **minimum design pressure** (MDP) at the connection point shall be identified using the FY(5) model.

Where it is expected the model pressure will be lower in any interim year this shall be identified for inclusion within the quotation, as the **interim minimum design pressure**.

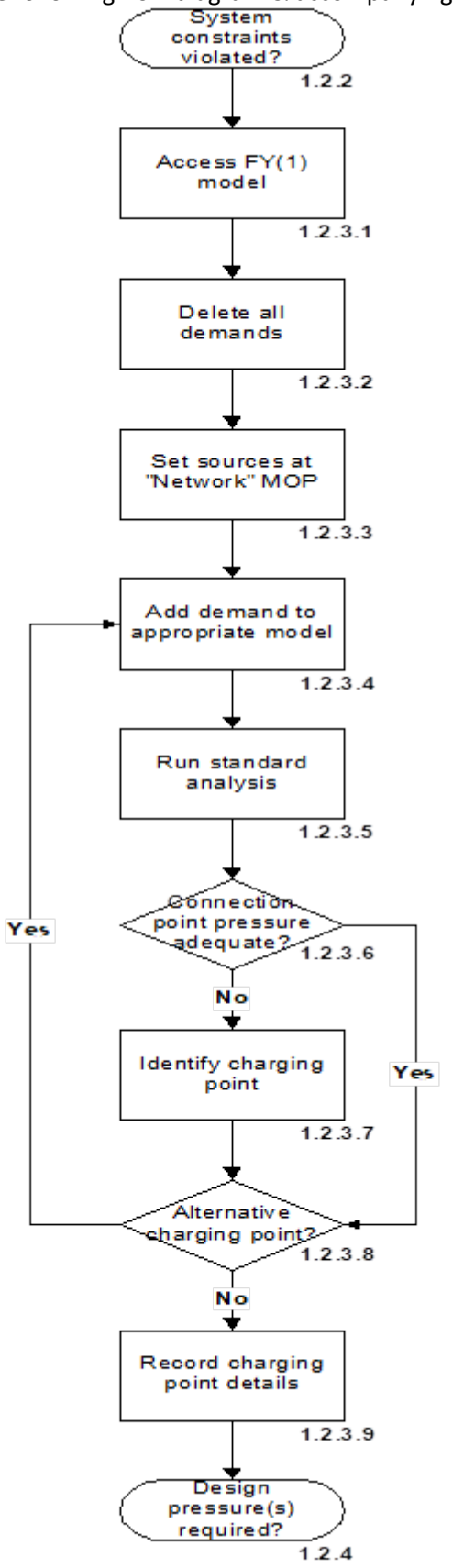
It is important therefore that cognisance not only be taken of anticipated demand, but also any planned strategy for the network that may see a significant impact on the network configuration. This would include planned reinforcement and/or leakage reduction project that may involve significantly lower operating pressures than those currently experienced.

Pressures used for quotation purposes should be at least those minimum pressures taken from Tables A2 or A3.

The identification and provision of design pressures to non-typical demands shall be in accordance with Section 12.

14.7 Identify network analysis response

The following flow diagram & accompanying notes shall be followed when identifying the Charging Point



14.7.1 Identification of Charging Point – supporting text

The Charging Point is the nearest point, subject to Note 1, on a main of the requested pressure tier, where the fully developed load can be supplied with no other loads on the network. The charging point is a theoretical entity that creates the financial distinction between the 'connection', which is fully charged to the customer, and the 'system reinforcement', which should be funded by SGN (subject to the economic test).

This process shall be used whenever a potential load cannot be supplied from the nearest main of the pressure tier requested, or higher, (subject to normal SGN Connections Policy Manual rules for connection) without reinforcement being provided. In these circumstances, the charging point shall be identified via network analysis with the potential load as the sole demand on the network.

Where a supply to a consumer using a compressor/booster is proposed, any Charging Point shall only lie on a main which is at least the same diameter as the new connecting pipe. In this context the connecting pipe may be either a main or service depending upon the physical location in which it is to be laid.

Note 1: Activities associated with the identification of the charging point, as part of this process, shall be undertaken in accordance with, and subject to, Scotia Gas Networks' Connections Policy Manual.

Access FY (1) Model

For the purposes of this document, the FY (1) pipe model shall not include any proposed physical reinforcement identified as part this specification.

Delete all Demands

All demands (both Potential and Existing) shall be removed (on a temporary basis) from the model using the Global Delete command.

For network analysis models that contain regulators it may be necessary to analyse the discrete supply section. Source pressures for other discrete systems within the same network should be ignored as a network analysis model containing regulators may fail to analyse when all demands are removed due to zero flow conditions. If this occurs, the network should be modified to isolate the discrete supply section from the remaining network. The regulator(s) should be replaced with a source(s) to reflect the regulator flows.

Set Sources at 'Network' MOP

All sources, within the supply section shall be set at the highest source pressure i.e. at the section MOP. Source capacities should be left on as they represent a design capacity constraint

Where the Network has a Pressure Management System, the control loops between the governors and the extremities shall be omitted.

Add Demand to Appropriate Main

The relevant potential load(s) shall be added to the nearest relevant main of the requested pressure tier or higher. Where the customer does not specify a pressure tier requirement, the load shall be added to the nearest main. Where a GT identifies a C16 demand, two analyses shall be carried out and the impact of the addition of both identified.

Where the requested pressure exceeds that available from the nearest pressure tier, the load shall be added to the next, upstream, pressure tier until the requirement is satisfied. Where a High-Pressure Distribution System or Transmission connection is requested, the application shall be referred to High Pressure Distribution System Planning or Transmission Planning for evaluation.

For the purposes of this document, the physical connection is assumed to lie on the nearest main that allows a physically feasible mainlaying route to be used (e.g. there are no obstructing buildings or significant obstacles).

Run Standard Analysis
No additional information required.

Connection Point Pressure Adequate?
For the purposes of this document the connection point pressure is adequate where it is not less than the values shown in section 16 "Minimum System Pressures for Charging Point Purposes". If the pressure at the connection point is at, or above, the minimum system pressure, then this is the Charging Point.

NB: When analysing the network to identify the charging point, velocity should be ignored as the charging point is a theoretical point for allocating costs between reinforcement and connection charges. However, the velocity constraint should be taken into account when undertaking the design of the physical solution.

The derived charging point values, contained in section 16, are system minimum pressures and do not take account of contractual agreements with other parties for higher pressures. It should be noted that these pressures identify the system minimum pressures for Charging Point purposes only. They do not relate to the physical design.

NB: If an elevated pressure is requested the minimum system design pressure, described in section 16, still applies for charging point purposes only. All additional costs to provide elevated pressure, over and above the minimum system design pressure, should be considered to be an enhancement in accordance with SGN's Connections Policy.

Identify Charging Point
Where the mains pressure, at the anticipated point of connection to the parent main, falls below the minimum design pressure, defined in section 16, the first upstream node where the pressure is higher than that required shall be identified as follows:

Identify the pressure gradient in the pipe connecting this node to the next downstream node to calculate, by interpolation, the point where the pressure required at the connection point exists. This is a possible Charging Point.

NB: the Charging Point shall lie on a pipe of at least the same diameter as the service feeding a compressor/booster.

Alternative Charging Point?
There can only be one charging point. In establishing the charging point, consideration should be given to the possibility that it may exist on alternative route to, or higher pressure tier than that suggested as, the proposed method of supply.

Record Charging Point Details
See QMS for specific minimum information required.

Design Pressures Required?
Return to Process 2.

15. SPECIFICATION FOR THE MINIMUM NETWORK ANALYSIS RECORDS TO BE RETAINED FOR CONNECTIONS ENQUIRIES

All Network Analysis prints shall be retained where they have been used as the basis of a connections pressure for a quotation. This section defines the minimum requirement for network analysis runs that should be carried out for each category, together with the prints that should be retained.

For the majority of these enquiries where only the pressure is quoted, and where both models are available, this will be FY(1) and FY(5) with the new load included, since these are the runs used to generate the quoted pressure.

While it is anticipated that FY5 represents the longer-term network configuration of any network, it is possible that those will contain reinforcement planned for some point during the intervening period. As such, it is necessary to check pressures for FY1 to ensure these will not be lower and therefore require an Interim Minimum Design Pressure To Be Quoted as per Section 14.6.

Note: The matrix represents the **MINIMUM** information required for connections purposes only. It is suggested, however, that analysts may wish to carry out other runs/prints to ensure that the integrity of their network has not been adversely affected.

Job type	FY(1) Base	FY(1) With load	FY(5) Base	FY(5) With load	Charging point	Reinforcement options
No reinforcement	Y	Y	N	Y	N	N
With reinforcement	Y	Y	Y	Y	Y	Y

Table E1: Network Analysis Records For Connection Enquiries And Requests

Key

Y Mandatory
N Not mandatory FY(1) - Base Run
FY(1) - With Load added
FY(5) - Base Run *
FY(5) - With Load added

(This is discretionary where reinforcement is not required in FY(5) with load added. This is compulsory where reinforcement is required in FY(5).

16. MINIMUM SYSTEM PRESSURES FOR CHARGING POINT PURPOSES

Services

For maximum design pressure drop for all services see Table B1.

Pressure Tier	MOP/DMP		Charging Point Pressure
LP	MOP <=75mb	Pre Jan 1996	21mb
		Post Dec 1995	22.75mb
MP	DMP <= 270mb		350mb
	DMP <= 180mb		250mb
	DMP <= 105mb		140mb
	DMP <= 65mb		100mb
	DMP <= 35mb		70mb
IP	MOP <= 7000mb		2760mb

Table F1: Charging point pressures for <7bar services

System Extension

Pressure tier	MOP / DMP	Charging Point Pressure
LP	MOP <= 75mb	Section 10 - Table A2
MP	DMP <= 270mb	450mb
	DMP <= 180mb	350mb
	DMP <= 105mb	240mb
	DMP <= 65mb	150mb
	DMP <= 35mb	95mb
IP	N/A	3460mb

Table F2: Charging point pressures for system extensions

Elevated Pressure Requests

Where a requested source pressure is higher than the figures quoted in Tables A2 and A3 or the standard for IP, this elevated pressure should be used as the figure for identifying the charge point.

APPENDIX A – REFERENCES

This Specification makes reference to the documents listed below:

SGN/PM/NP/4	-	Management Procedure for Above 7bar Network Analysis
SGN/PM/NP/16	-	Management Procedure for Below 7bar Network Analysis
SGN/PM/NP/18	-	Management Procedure for Network Planning
SGN/SP/NP/10	-	Specification for Defining Pipes and Mains, Services or Network Risers
IGEM/GL/1	-	Planning of Gas Distribution Systems of MOP not Exceeding 16bar
IGEM/GL/2	-	Planning of Gas Transmission and Storage Systems Operating at Pressures Exceeding 16bar
IGEM/TD/3	-	Steel and PE Pipelines for Gas Distribution
IGEM/TD/4	-	PE and Steel Gas Services and Service Pipework
GIS/PL2	-	Gas Industry Standard for Polyethylene Pipes and Fittings

ENDNOTE

Comments

Comments and queries regarding the technical content of this safety and engineering document should be directed to The SHE and Engineering Registrar at

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