Technical standards and specification manual

For natural gas distribution systems in Alberta
7th edition (2020)

Alberta

The following organizations participated on the 2020 Technical Standards Manual (TSM) Review Committee:

Rural Utilities, Agriculture and Forestry
Federation of Alberta Gas Co-ops Ltd.
Apex Utilities Inc.
ATCO Gas and Pipelines Ltd.
City of Medicine Hat
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Technical Standards and Specification Manual for Gas Distribution System |Agriculture and Forestry

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Table of Contents

Foreword

This Seventh Edition of the Technical Standards and Specifications Manual for Natural Gas Distribution Systems in Alberta (hereafter Technical Standards Manual or TSM) has been updated to reflect changes to technical standards in the design, construction and operation of natural gas distribution systems which have occurred since 2010.

This manual is issued in accordance with provisions of Section 2(1) of the *Gas Distribution Act* and is the standard as set by the Chief Officer.

The Technical Standards Manual is intended to provide a guide towards the safe design, construction and operation of a gas distribution system that should meet the requirements of the Chief Officer under the *Gas Distribution Act* and the applicable Acts, Regulations, Codes and Standards of Alberta. Appropriate technical resources including the use of qualified gas distribution professionals, are required to aid in its interpretation, implementation and no warranties or guarantees are afforded thereof.

Operational and Maintenance practices are mentioned throughout this manual; however the Technical Standards Manual is not intended to replace the requirements of a separate Operations and Maintenance manual, in accordance with standards set by the Chief Officer policies.

1. Scope and Application

The scope of the Technical Standards Manual is limited to:

- Any part of a rural gas utility that has been approved under the authority of the *Gas Distribution Act*, and
- Any low pressure distribution pipeline (i.e. operating at 700 kPa or less) located within Alberta.

This, and the responsible pipeline jurisdictional authority, is illustrated in Figure 1.1, a general illustration of a number of common gas distribution installation scenarios found throughout Alberta.

These scenarios include:

A: a farm or rural residential property;

B: a colony or corporate farm;

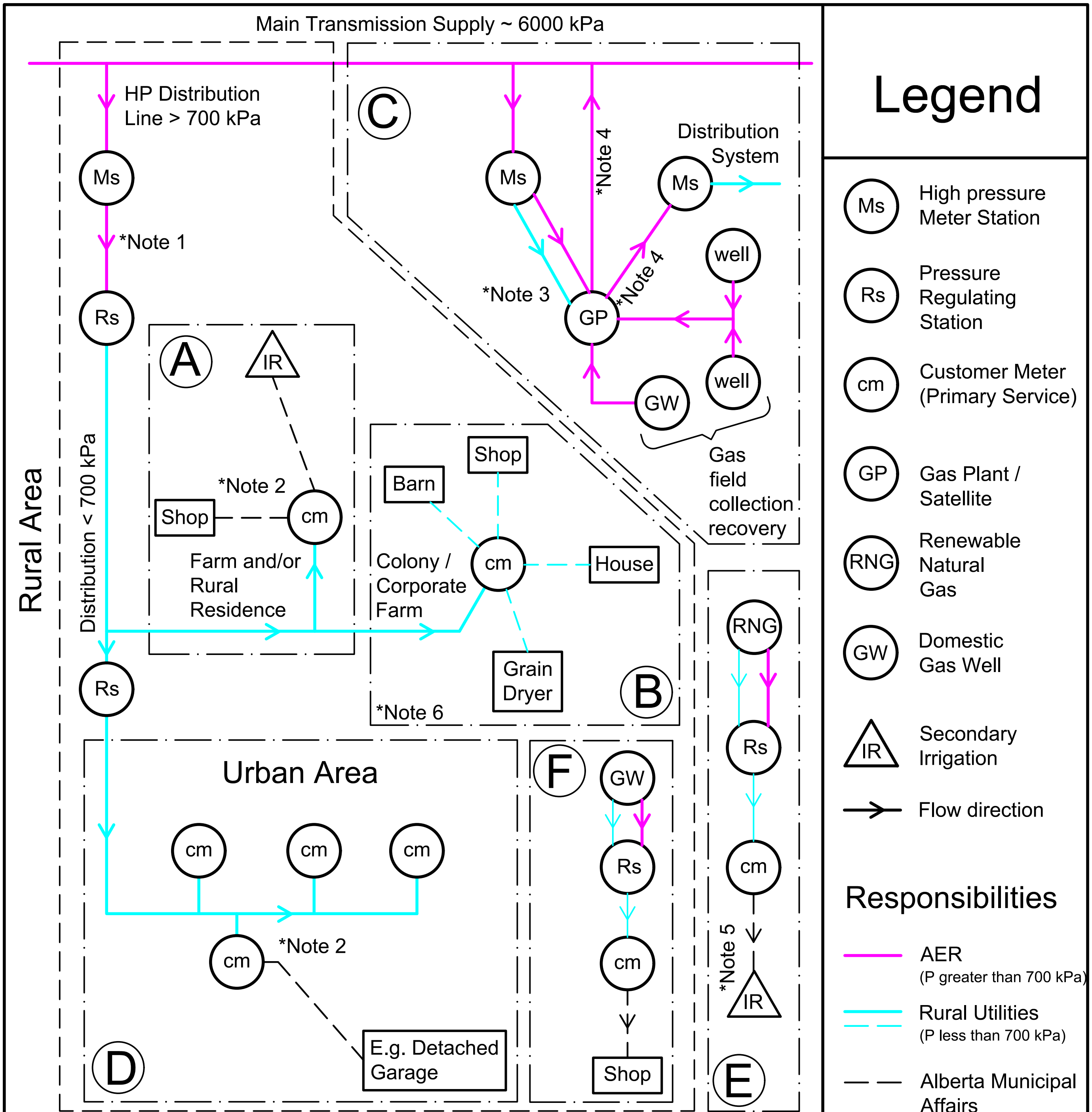
C: a gas field collection/recovery scheme;

D: an urban area;

E: a renewable gas production facility, and

D: a domestic, privately-owned gas well.

The TSM covers the key aspects of safety, design, construction and operation, which the Chief Officer (as defined in the *Gas Distribution Act*) considers necessary for the controlled, coordinated development of gas distribution pipeline infrastructure throughout Alberta so as to serve the largest number of Albertans in an efficient, safe and economical way.



NOTE: This diagram is for general illustration only. Rural Utilities and the utility may require modifications to address legislative requirements for specific scenarios.

FIGURE 1.1 SCOPE OF MANUAL

NOTES:

1. High pressure pipelines that are downstream of transmission pipelines have a AER responsibility;
2. Secondary pipelines downstream of the outlet of the customer meter set assembly owned by the utility, is under the regulatory authority of Alberta Municipal Affairs;
3. Infrastructure installed and maintained by the Rural Utility within an oil and gas gathering scheme may fall under the jurisdiction of the Rural Utilities or the AER depending on operating pressure;
4. Regardless of operating pressure, pipelines from the Gas Plant/Satellite to a metering/regulating station are under the jurisdiction of the AER;
5. As a private biogas system, the system may be under the regulatory authority of Alberta Municipal Affairs. Permits may be required;
6. For private distribution systems, Rural Utilities' authority extends from the custody transfer station (e.g., supply from the rural utility, transmission pipeline, domestic well) extending through to any final regulator assembly external to the facilities being served.

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2. Reference Legislation, Regulations and Standards

The design, construction and operation of gas distribution systems are subject to statutes and regulations issued by the Government of Alberta and the Government of Canada. In addition, applicable publications of the Alberta Occupational Health and Safety Code (OH&S), the Canadian Standards Association (CSA) and other gas-related industry organizations shall be adhered to.

The latest edition of the CSA standard published as CSA Z662 "Oil & Gas Pipeline Systems" shall be considered as the principal guideline for the design, construction and operation of all gas distribution systems. Regulations covering gas distribution systems in Alberta require compliance with the CSA Z662 standard, although the Technical Standards Manual includes some variations to provisions outlined in the CSA standard that are acceptable by the Chief Officer under the *Gas Distribution Act*.

Since the scope of this manual covers natural gas pipelines, which fall within the multiple jurisdictions of Rural Utilities (RU), the Alberta Energy Regulator (AER) and the Safety Codes Council of Alberta (under Alberta Municipal Affairs), the more stringent of any specification applies in situations where multiple jurisdictions apply. Also, other municipal, provincial or national legislation and/or specific requirements (i.e. offsets from or encroachments on municipal roads) may exceed a similar specification contained in this manual.

3. Definitions

Terms used are either legislatively defined in the *Gas Distribution Act* or are the acknowledged natural gas distribution industry meaning of certain words or phrases as used in this manual.

Specifically for the purpose of this manual only:

"**gas distribution system**" – the same meaning as 'rural gas utility' as defined under the *Gas Distribution Act* - a system of pipelines used for the supply, transmission and delivery of gas to consumers in a franchise area.

"**low pressure distribution pipeline**" – a natural gas pipeline operating at a pressure of 700 kPa or less.

"**distributor**" - includes any organization or person that owns a system of pipelines used for the supply, transmission and delivery of gas to consumers and must abide by this manual: rural gas utility, municipal utility, First Nation utility, Metis Settlement utility and owners/operators of low pressure distribution pipelines.

4. Design

A gas distribution system designer will usually have many considerations and options available to them when sizing and routing a new distribution system, or adding to an existing distribution system to improve capacity. This section discusses pertinent design considerations specific to the calculation of system pipe sizing (i.e., connected load, peak demand, and coincident factors), pipe sizing equations, and general construction considerations. Although not discussed within this manual, the designer should also consider the location of consumers in relation to the gas source, the ability to gain right-of-entry to lands, and the terrain conditions in the area as principal factors in the system's design.

4.1 General

A distribution system is an integrated network of gas distribution pipes and associated appurtenances, which in its most basic form is composed of services , main lines and a gas supply source typically referred to as a regulating station or Regulating, Metering, and Odourization station (RMO).

When designing a new distribution system, or adding to, or improving an existing system, a certain amount of judgment and flexibility is required by the designer.

"**Main**" means that part of a distribution system from the outlet of a regulator station and upstream of service lines.

For example, when sizing the main lines the designer will need to compile all available information and apply judgement and their experience when deciding whether to size the line based on either current needs or the need for additional capacity in order to serve future growth. This decision will depend, in part, on how the peak hour design loads are derived and applied to forecasts to serve consumers' needs.

The needed volume of gas, and subsequent system pipe sizing (i.e. pipe diameter), is determined from a combination of the following three criteria:

1) Maximum Connected Load
2) Peak Hour Demand
3) Coincidence Factors

To accurately design a distribution system, the services of a qualified gas distribution professional recognized by the *Engineering and Geoscience Professions Act* must be retained to design the system requirements. Qualified professionals are outlined below:

Association of Professional Engineers and Geoscientists of Alberta (APEGA)

- Professional Engineer (P. Eng.)
- Professional Licensee (P.L. (Eng.))

Association of Science and Engineering Technology Professionals of Alberta (ASET)

- Professional Technologist (P. Tech (Eng.))

"**Coincidence Factor**" means the ratio of the total connected load and the probability of the connected equipment running simultaneously. The coincidence factor recognizes that the total connected load will not be on at the same time. The coincidence factor is dimensionless and expressed as a decimal that is always less than or equal to one.

The Chief Officer will acknowledge and generally accept the fact that the designer may select a design option of their own choosing. The Chief Officer may, however, request the use of an engineer-approved alternative design when in its opinion, the alternative will be more effective and cost efficient or be in the public interest to do so.

Consumer Load Surveys

Where a consumer load survey is to be conducted to provide the designer with the maximum connected load and to permit extrapolation of peak design loads, the form illustrated in Figure 4.1 or an equivalent shall be utilized.

Care must be taken in establishing future load requirements and the requirements for large load equipment since this information has a significant impact on system sizing and costs. While allowance should be made for future additional loads, the load established should be a realistic projection of the consumer's future requirements. Similarly, large load equipment should be carefully analyzed to ensure that the volume of gas set aside for this requirement is sufficient, but not excessive.

4.2 Establishing Maximum Connected Load

The maximum connected load of a consumer shall be calculated by establishing and tabulating the burner input rating of all appliances. This may include, but is not limited to, a gas-fired furnace, water heater, fireplace, clothes dryer, oven and all stove top burners. The maximum connected load ensures that the service line will always be able to supply all of the connected appliances running at full capacity at the same time while maintaining a suitable end pressure under normal operating conditions.

"**Service line**" means a distribution pipeline dedicated to serving a single consumer.

When establishing the maximum connected load, the designer may also need to consider specialized agricultural equipment such as irrigation engines and grain dryers that are being served from the same service line and meter. Due to the seasonal utilization of this equipment, to simply total the maximum burner rating with that of household appliances may oversize the service line. As such, the designer may have to apply some judgment in establishing the maximum connected load factor in these specific situations.

4.3 Establishing Peak Hour Demand Loads

Main pipe sizing is influenced primarily by the maximum hourly volume of gas being transported by the system. The designer is to ensure that the system meets the requirements of the consumers served by the distribution system at peak hour loads.

The peak design load is the hourly load which is used to size system mains and is derived by applying a "coincidence factor" to the maximum connected load. The coincidence factor is the ratio of the total connected load and the probability of the connected equipment running simultaneously. The coincidence factor recognizes that the total connected load will not all be operational at the same time. The coincidence factor is dimensionless and expressed as a decimal that is always less than or equal to one.

4.4 Establishing Coincidence Factors

It is the designer's responsibility to establish realistic coincidence factors for sizing mains. The designer will recognize that each distribution system is unique in this respect due to the significant variations that exist between the number and type of consumers, the influence of seasonal loads, loads that are not sensitive to ambient temperature changes, and other factors that may influence natural gas use. A designer should, therefore, establish their own guidelines based on a comparison between the calculated theoretical pressure drop and the actual pressure drop at the lowest ambient temperature observed.

The value of the coincidence factor varies indirectly with the number of consumers being served from the main which is being sized; the greater the number of consumers, the smaller the value of the coincidence factor. For example, a main servicing a large group of consumers may be required to transport a peak design load of only 75 per cent of the total connected load of that group of consumers due to such factors as the intermittence of gas demand for heating load, the variations which exist in the personal habits of consumers, and the burner rating of furnaces relative to building heat loss. In this example, the coincidence factor of 0.75 would ensure that the mains would be sized to carry sufficient but not excessive capacity to meet the needs of consumers at peak flow conditions without being oversized. For single customer additions, a higher factor of 1.0 may be more appropriate for the segment of main up to the service line.

FIGURE 4.1

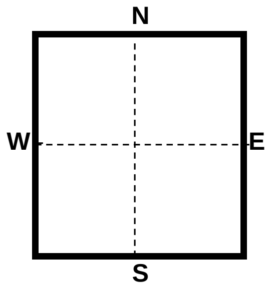
LOAD SURVEY FORM - RURAL GAS PROGRAM

Gas Distributor : ____

Date: ____________

LSD

13	14	15	16
12	11	10	9
5	6	7	8
4	3	2	1



New Survey ☐

Re-survey ☐

The Diagram shown represents the section on which the consumer/ service riser is located. Please indicate the loation of the service meter on the section map and complete the remainder of the form below.

Owner's Name ____________________

Account # ____________ Riser # ____________

1/4 Section ________ Section ________

Township ________ Range ________ W__M

Lot ________ Block ________ Plan # ________

PRESENT BTU/HR REQUIREMENTS

Main House ☐ **Secondary House** ☐ **# of Storeys** ____________

Appliance	**Basement**	**Main Floor**	**On Demand**	**BTU/hr**	**Comments**
Furnace	☐	☐	☐		
Furnace	☐	☐	☐		
Furnace	☐	☐	☐		
Fireplace	☐	☐	☐		
Water Heater	☐	☐	☐		
Water Heater	☐	☐	☐		
Clothes Dryer	☐	☐	☐		
Stove	☐	☐	☐		
Other	☐	☐	☐		

Outside Buildings

Type of Building	**Appliance**	**BTU/hr**	**Pressure**	**Comments**

Large Use

Irrigation ☐ **Pressure** ________ **BTU/hr**

Gas Engine BHP ________ X 12000 BTU/hr ________

Season Start / End ________ / ________ ________# of Hours Per Day________ Avg

BTU/hr

Grain Dryer ☐ ________ **Pressure** ________ ________

Season Start / End ________ / ________ ________# of Hours Per Day________ Avg

BTU/hr

Other ☐ ________ **Pressure** ________ ________

Remarks

____

____

____

____

Note: Natural Gas Fired Generators, Aerators, Bin Heaters, and Boilers can be listed under the Large Use Section

4.5 Pipe Sizing for Distribution Systems

As noted in Section 4.1 the principal factor influencing the sizing of a distribution system is the peak design load which the system is required to transport. The next most significant factor in determining pipeline sizing is the mathematical model used to calculate dynamic pressure loss over a segment of pipeline. A number of suitable models exist which are applicable to a rural gas system design including the General Flow Equation and the IGT Flow Equation. These models, and any other comparable models that utilize the Reynolds Number for prediction of flow conditions within a distribution pipeline, can be used to determine pressure loss.

"**General Flow Equation**" means a mathematical expression that can be used to calculate the pressure (gauge) and flow (volume rate) of a fluid in a distribution system at any point taking into account the frictional losses due to drag, fluid interaction and outflows/inflows on the system at local ambient temperature and atmospheric pressure of the system. Different equations may be utilized depending on the type of fluid, pipe size, flow characteristics which best satisfies real world results. The **IGT (Institute of Gas Technology) Flow Equation** is a variant of the general flow equation to predict a pressure drop in a gas pipeline

An additional factor that affects the pressure calculation is the internal roughness of the pipe, which is dependent upon its manufacturing material. Modern day distribution pipe is made from polyethylene (PE) which has a very favorable (i.e. low) roughness constant. The lower the pipeline material's roughness constant, the less impact does it have on the pipeline's pressure drop.

In addition to these three factors, design coefficients used in the determination of the pressure rating of pipelines needs to ensure a 50 to 100 year design life of the gas distribution system. HDB design rated materials such as 2406, 2708 and 4710 have the design coefficient already considered as part of their overall pressure rating. In comparison, MRS design rated materials such as PE80 and PE100 pipe, CSA Z662 indicates a design coefficient (C) equal to 2.0 is needed to ensure a similar design life for gas distribution systems installed with this type of pipeline material. Approved polyethylene (PE) resins and codes suitable for pipeline installation are identified in Appendix C.

"**HDB**" - Hydrostatic Design Basis and "**MRS**" - Minimum Required Strength are two different methods used to calculate the maximum operating pressure of polyethylene pipe.

4.5.1 Degree Day Method

Where it is necessary to consider the loads of existing consumers (for example, designing a loop line), the peak design load for those consumers may be estimated by considering the consumers' actual consumption for a specific billing period and the number of degree-days locally for that period. This method can be found in Appendix A.

The advantage of the degree-day method is that it is based on actual consumption and eliminates the need for new load surveys. Its use is, however, limited to existing consumers who have generated a billing history and whose peak design load is primarily influenced by ambient weather temperatures (i.e. space heating purposes).

4.6 General Construction Design of Distribution Systems

Within general construction design of the distribution system, there are a number of considerations for the designer to consider. These include improving system capacity, routing considerations, depth of cover and clearance requirements, pipeline/cable crossings, and the use of rights of way.

4.6.1 Capacity improvement of Distribution Systems

Improvements to existing distribution systems to overcome inadequate flow capacity should consider the following options:

• A simple loop line paralleling the existing system main for a sufficient distance. The segment of the existing system to be looped should be carefully selected to ensure maximum impact at a minimum cost.

• Use of interconnecting systems, which allows gas to be conveyed to pipelines and customers from areas of the distribution system where supply exceeds existing or current demand (i.e. reallocation of supply).

• Uprating of existing system components in order to increase overall system pressure. Consideration of pipe integrity, customer regulators, code requirements and Bulletins from Rural Utilities will impact the use of this option.

4.6.2 Routing of Distribution Systems

The routing selected for a proposed new distribution system or pipeline, or an improvement to an existing system should be determined by a combination of the following criteria:

a) The requirements of any government body, or any regulatory authority (including Indigenous Peoples), having jurisdiction over the land, waterway, railway, or roadway affected by the location of pipelines on or adjacent to that property.
b) The requirements of any landowner whose property will be directly or indirectly affected by the location of pipelines on or adjacent to that property.
c) The requirements of any owner of a utility line whose pipeline or cable is to be traversed by the distributor's pipeline. In addition, the designer should take account of the effect of overhead power lines on a steel or aluminum pipeline that is to be located adjacent to that power line.
d) Any municipal proposal to amend the use of the land in which the pipeline is to be located.
e) The sub-surface condition of the land in which the pipeline is to be located. Where it is feasible to do so, location of pipelines in land with sub-surface rock, in either solid or loose formation, should be avoided.
f) The surface condition of the land in which the distribution pipeline is to be located. Where it is feasible to do so, location of pipelines in swamp, muskeg, or bodies of water, or in land which is covered by timber or dense brush, should be avoided. Consideration of sensitive species also needs to be taken into account.
g) The possibility of soil erosion or removal. When necessary, a geotechnical study should be conducted to assist the designer in establishing effective methods of avoiding or controlling severe soil erosion which could adversely affect the condition and operation of the pipeline.
h) The location of all suitable gas sources having regard to the proximity of the majority of consumers to be served from the pipeline system supplied from the selected gas source.
i) The ease of access to the location of pipelines for initial construction and for subsequent inspection, maintenance and repair of pipelines.
j) The capital cost associated with alternative routes.

4.6.3 Depth of Cover and Clearance

For normal operation conditions, pipelines should be installed with the following minimum depths of cover:

a) For service lines and mains, the minimum depth of cover shall be 800 mm.
b) For crossing of highways, roads, railways, canals, watercourses and foreign pipelines or cables, the minimum depth of cover should be determined from Section 4.6.4

The minimum clearance to be maintained between a pipeline and any other facility or structure that it parallels or crosses shall be in accordance with the latest edition of the CSA Z662, and should consider any relevant specifications of the owner of the facility or structure.

4.6.4 Crossings of Other Facilities

The design of any distribution pipeline crossing highways, roads, railways, canals, watercourses and foreign pipelines or cables must receive the prior approval of the owner, administrator or authorized agent of the right-of-way or facility that is to be crossed. Typical crossing profile designs and dimensions acceptable to the Chief Officer are illustrated in Figures 4.3 to 4.6.

The depth of cover for buried pipelines at all crossing locations should be determined from a review of operational safety factors which may cause damage to a pipeline. These factors include stress loading, sub-surface materials, special soil cultivation methods within the right-of-way, and potential ground disturbance above or adjacent to the pipeline.

The depths of cover specified in Table 4.2 and Figures 4.3 to 4.6 should be considered only as standard dimensions that reflect the operational factors typically found at each type of facility to be crossed. However, it may be prudent or necessary to increase the depth of cover to address special factors that may be revealed in consultation with the owner, administrator or agent for the facility that is to be crossed. In particular, planned improvements to highways or roads should be considered and the location and/or the depth of the crossing should take account of any development plans by the road authority.

Since the distributor is usually faced with the cost of replacing or lowering its crossing when road improvements take place, it is in the distributor's interests to initiate consultation with the road authority to ensure that the crossing is located and designed so that it will remain undisturbed for its operational lifespan, even if future road development/improvement takes place at the crossing site. This consultative process applies to the following aspects of highway or road crossings as outlined in Table 4.2 and Figure 4.3:

a) The depth of cover under the lowest point in the right-of-way (usually the ditch bottom) is as a minimum either 1100 mm or 1400 mm, depending on the type of road being crossed (see Figure 4.3).
b) Depth of road crossing should be increased if in consultation with the road authority it is determined that future roadway development plans will necessitate pipe replacement or lowering or both.
c) The standard distance of any vertical bends from the edge of the right-of-way is as specified in Table 4.2 as the permit area(s). Where this standard distance is difficult to maintain due to terrain and/or access problems, application may be made to the road authority for a lesser distance. However, where approval for a lesser distance is granted by the road authority, the distributor will have to accept the responsibility for the cost of lowering or relocating the pipe should this be required by future roadway improvements.
d) Crossings of undeveloped road allowances at the nominal installation depth of 800mm should only be made following consultation with the road authority and confirmation that the road allowance is unlikely to be developed. If road development is planned or anticipated to be planned in the future, the crossing should be designed and installed to suit the profile of the proposed road.

See Section 5.9 for information relating to road crossing warning signs.

"**Ground disturbance**" means any work, operation or activity that results in a disturbance of the earth including, without limitation, excavating, digging, trenching, plowing, drilling, tunneling, auguring, backfilling, blasting, topsoil stripping, land leveling, peat removing, quarrying, clearing and grading, but does not include:

- except as otherwise provided in sub-clause (ii) below, a disturbance of the earth to a depth of less than 300 mm by hand excavation that does not reduce the earth cover over the pipeline to less than the depth of cover provided when the pipeline was installed.
- cultivation to a depth of less than 450 mm below the surface of the ground.
- any work, operation or activity that is specific in the [Pipeline] rules not to be a ground disturbance. (Pipeline Act, s.1(1)j)

Table 4.2 – Standard Dimensional Information for Highway or Road Crossings

ROAD TYPE	ROAD AUTHORITY	MINIMUM DEPTH OF COVER	PERMIT AREAS
Multi-lane provincial highways	Alberta Transportation	1400 mm	>115m from the centerline and 30m from edge of right-of-way
Major 2 lane provincial highways	Alberta Transportation	1400 mm	>60m from the centerline and 30m from edge of right-of way
Minor 2 lane provincial highways	Alberta Transportation	1100 mm	>50m from the centerline and 30m from edge of right-of-way
Local municipal roads, service roads, subdivision roads, or park roads	Local municipal authority or Alberta Transportation	1100 mm	At edge of right-of-way
Private roads	As applicable	1100 mm	At edge of right-of-way

Note: Unless specifically approved by the road authority, no bends shall fall within the existing or proposed right-of-way, or within the setbacks listed above. The location of horizontal bends relating to gas distribution pipelines paralleling road rights-of-way is covered in Appendix B.

4.6.5 Use of Road Rights-of-Way for Pipelines

The use of road rights-of-way for pipeline alignments in rural areas should be avoided wherever possible and should be used only where extenuating circumstances exist. In all cases, the prior approval of the road authority must be obtained before the pipeline installation can proceed and the authority must be consulted to ensure that roadway maintenance, sign installation or other work will not cause damage to or interfere with the operation of the pipeline.

Unless otherwise approved by the road authority, the pipe should be located under the ditch on the back-slope side. The entire length of the pipeline should be placed parallel to the centerline of the road or highway maintaining a consistent offset as much as physically possible.

The minimum depth of cover as specified in Table 4.2 should be a vertical depth measured from the lowest point of the ditch as illustrated in Figure 4.3. Warning signs should be installed along the entire length of the pipeline route within the road or highway rights-of-way at such frequency or intervals as are required to clearly identify the location of the pipeline. Such locations may include approaches and utility crossings

This specification does not apply to pipeline installations within hamlets, subdivisions or incorporated urban areas. For information regarding paralleling roads administered by Counties and M.D’s, refer to Appendix B for more information.

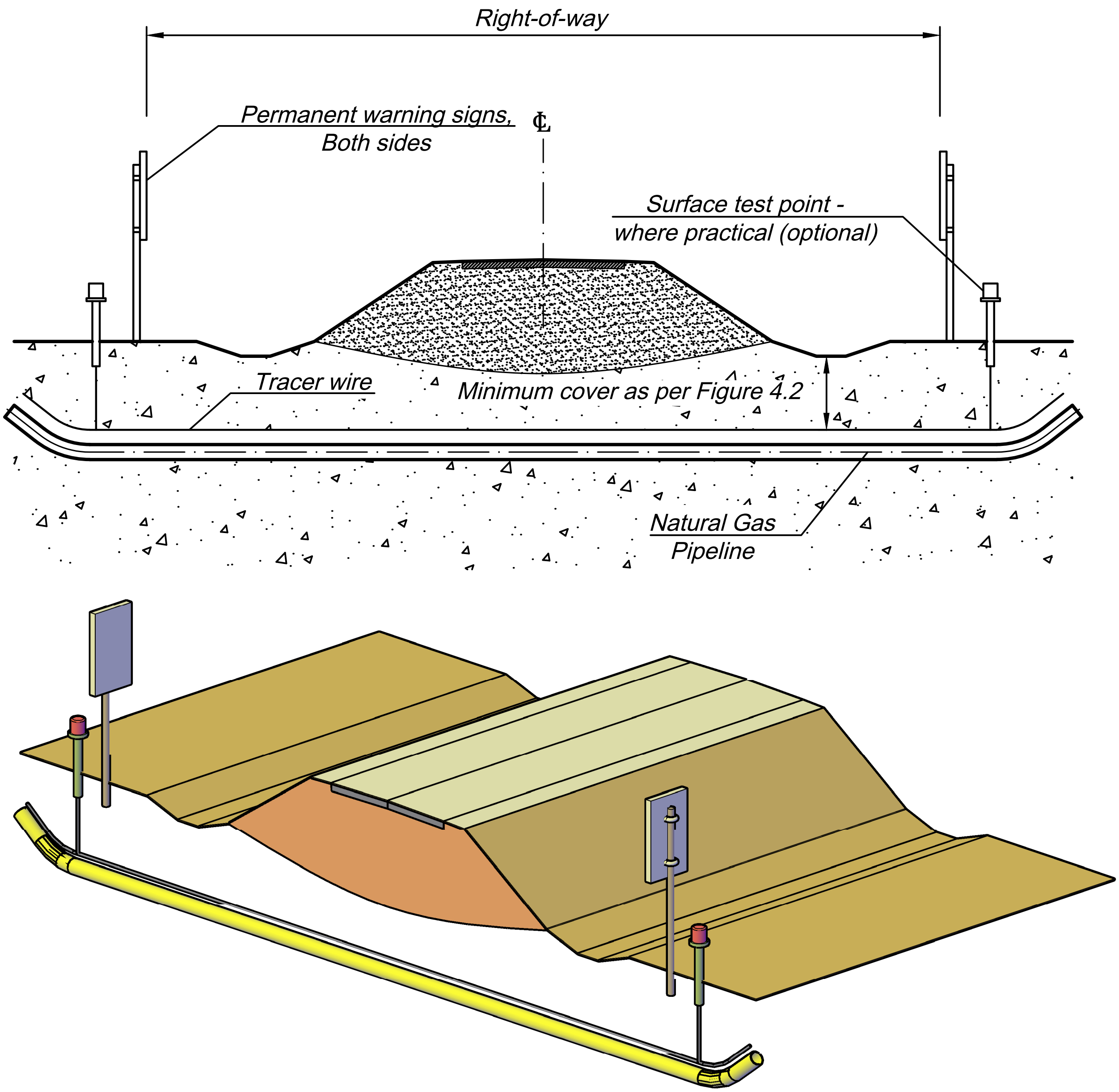


FIGURE 4.3 TYPICAL HIGHWAY OR ROAD CROSSING

NOTES:

1. Minimum depth of cover to be maintained for entire width of Right-Of-Way (R.O.W.) or as in Figure 4.2;
2. Tracer wire should be laid continuously across the R.O.W. and where practical, can be brought to the surface in a protective sleeve on one side of the R.O.W.

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2020

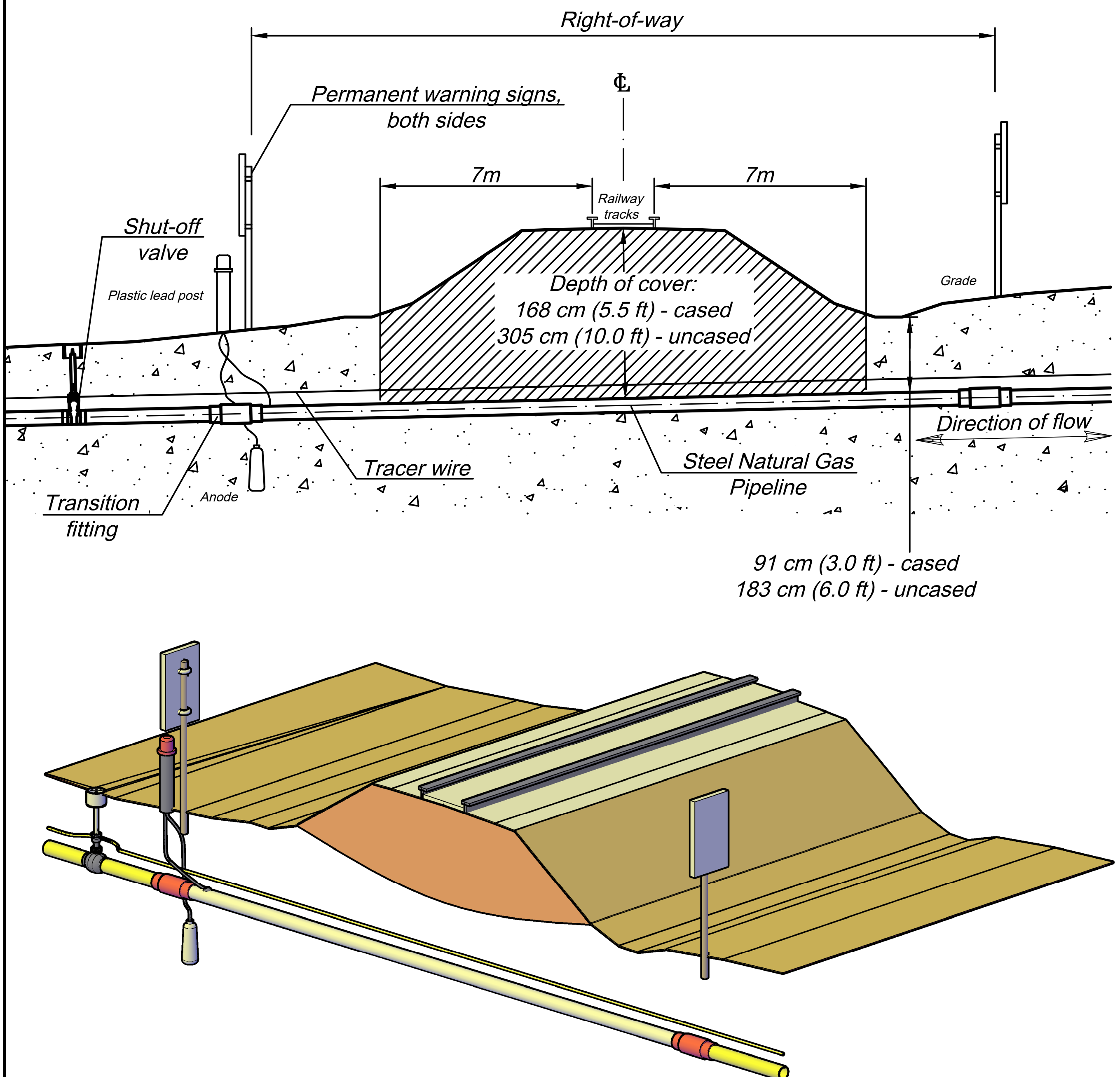

FIGURE 4.4 TYPICAL RAILWAY CROSSING

NOTES:

1. National railway crossings to be built and maintained in accordance with Transport Canada's "Stansards Respecting Pipeline Crossings Under Railways - TC E-10 (as revised at time of construction);
2. Crossing materials may be either uncased steel carrier pipe c/w suitable coating and cathodic protection or cased PE with steel casing. Material to be specified in consultation with railway owner;
3. Other railway crossings to be built in accordance with CAN/CSA Z662 (as revised at time of construction);
4. Shut-off valves are to be located within effective distances from rail crossing for emergency shut downs. Note distance to nearest valve for segment isolation on drawings

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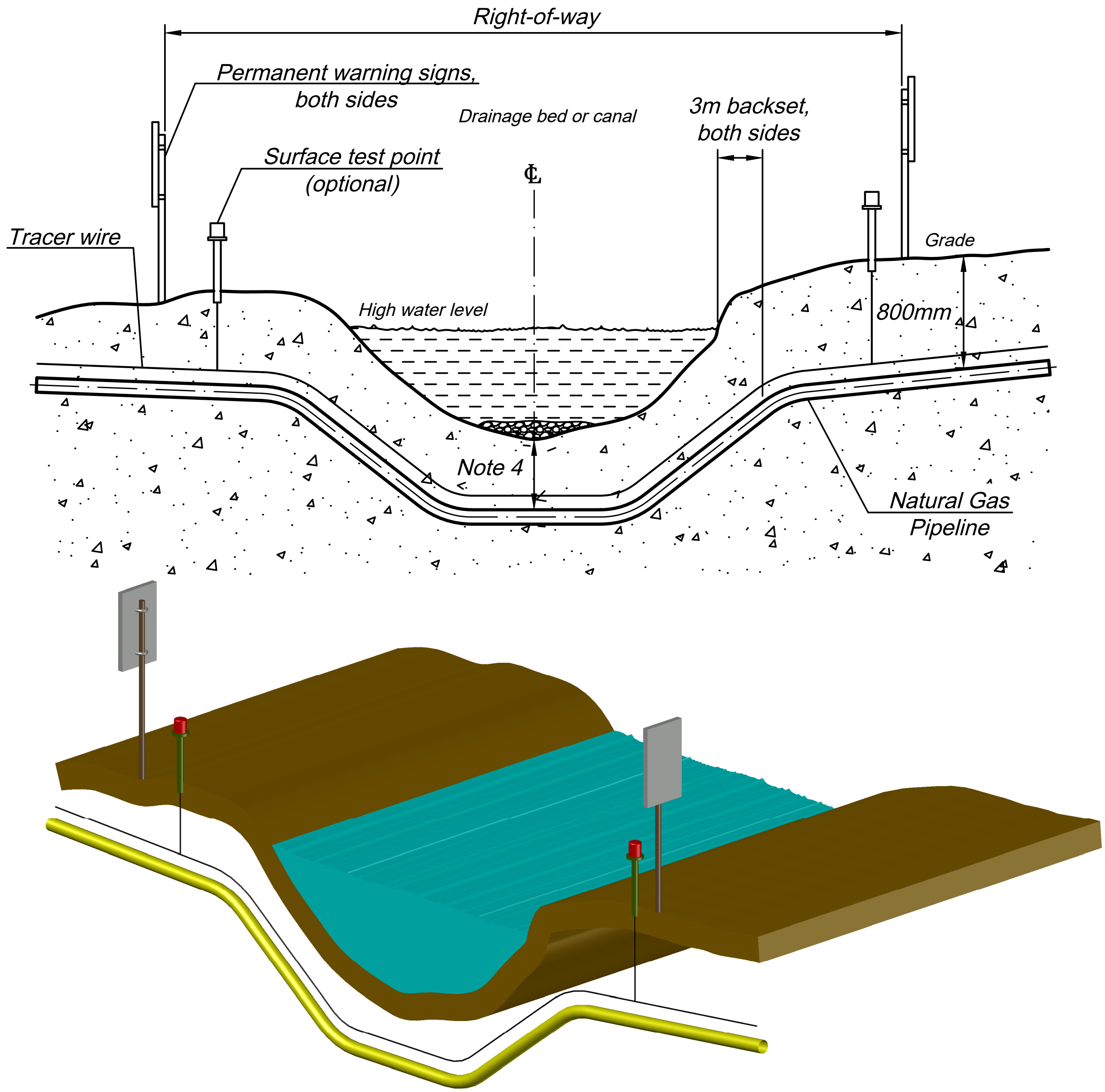

FIGURE 4.5 TYPICAL WATERCOURSE CROSSING

NOTES:

1. Minimum cover to be kept until 3m backset of the high water mark;
2. Design and installation to be in accordance with Alberta Environment, Water Act, Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body (current edition at time of construction);
3. Canals and Irrigation Ditches may have different requirements, check municipal bylaws;
4. Min. depth is the 50 year scour depth or 1.2m whichever is greater.

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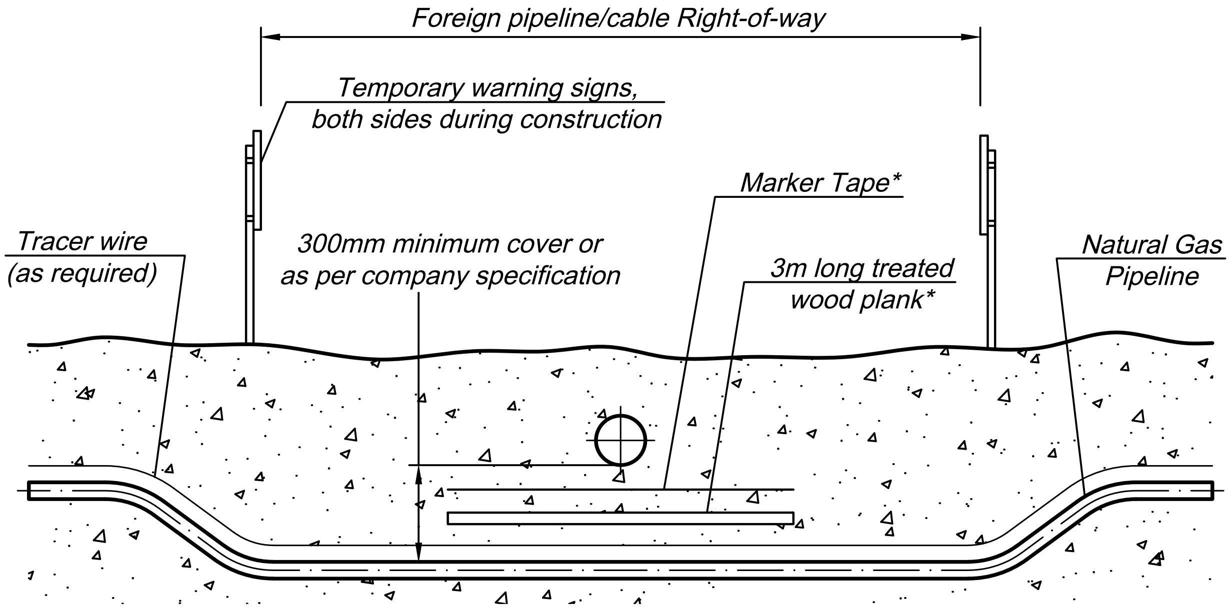

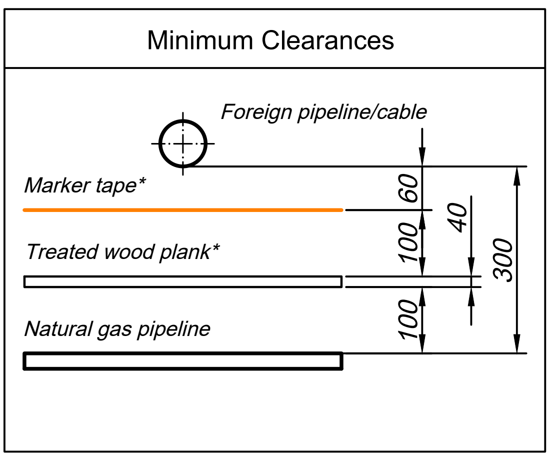

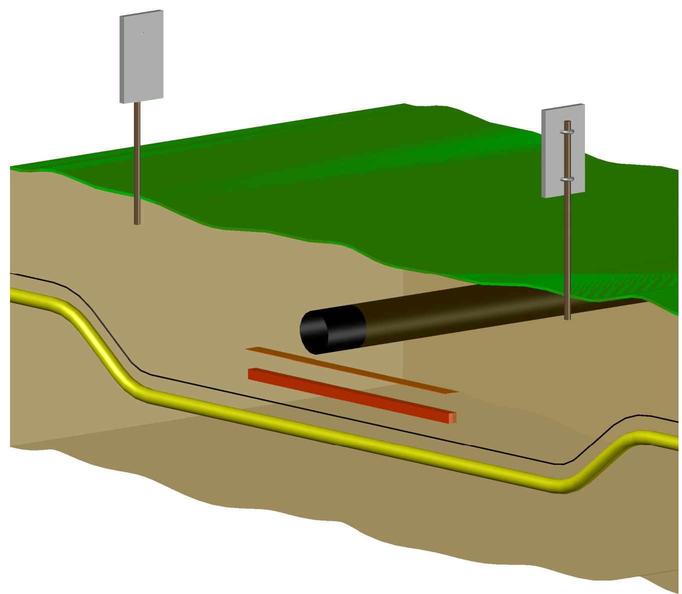

FIGURE 4.6 TYPICAL PIPELINE / CABLE CROSSING

NOTES:

1. Foreign pipeline/cable locations to be determined in the field;
2. * Installation of marker tape and treated wood plank is optional, unless specified by foreign pipeline/cable owner;
3. Temporary warning signs are optional during construction of cable crossings.

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5. Construction

5.1 General

Construction of distribution systems or pipelines which fall within the scope of this manual must not commence until the Distributor is in receipt of all approvals, permits or rights-of-entry granted by regulatory authorities having jurisdiction, landowners, and the owners or administrators of any other lands or any facilities which are to be crossed. All construction must be carried out in accordance with approved designs and specifications and with recognized safety practices.

5.2 Material Specifications

All materials intended for installation within the scope of this manual must comply with the requirements of any regulatory authority having jurisdiction and with any applicable CSA standard(s). Gas meters and ancillary instruments and controls must comply with the requirements of Measurement Canada. All new polyethylene resins or new pipe material used for low-pressure distribution in Alberta must be approved by the Chief Officer prior to installation. Only CSA B137.4 (Polyethylene Piping (PE) Systems for Gas Services) approved yellow polyethylene pipe (PE) that meets or exceeds testing under the Rural Utilities' Quality Assurance Program shall be accepted for installation. While yellow polyethylene pipe (PE) is the preferred color offered in the material standard, the other color option of black pipe with multiple permanent yellow markings from the same material standard may be acceptable when yellow pipe is unavailable. Multiple permanent yellow markings must provide assurance that the yellow striping will be clearly visible upon any excavation for the full lifespan of the pipeline. Chief Officer approval for the use of black, yellow-marked pipe is required prior to installation

Materials should be selected in accordance with the following criteria:

a) Safety of installation and operation.
b) Efficiency of operation.
c) Life cycle capital cost of project including operating and maintenance costs.
d) Availability of spare and replacement parts during the anticipated operating life.
e) The physical and chemical properties of the natural gas which is to be transmitted.
f) Where applicable, the atmospheric and environmental conditions under which the materials will operate.
g) The frequency, extent, and type of servicing which will be provided by the distributor.

Continuous, electrically conductive tracer wire shall be installed with all PE and reinforced composite pipe. It shall be a minimum 14 gauge with a minimum 0.8 mm (1/32") extruded PE coating and shall terminate at all accessible above ground locations. Below ground connectors for tracer wire should be specifically designed and manufactured to provide electrical continuity for the tracer wire. Tracer wire can be cathodically protected to defend against corrosion

5.3 Materials Handling

Suitable techniques should be developed to prevent damage to materials during transportation, storage, and installation. During transportation, all materials should be loaded and secured to the vehicle in accordance to the *Alberta Traffic Safety Act* and Commercial Vehicle Safety Regulation.

Materials should be stored and handled in a suitable manner to prevent damage from mechanical handling equipment, other vehicles, and weather conditions. Stick pipe should be stacked to a maximum height such that damage to bottom layers by crushing does not occur. Polyethylene pipe shall not be exposed to direct sunlight for more than three years from date of production (not date of purchase).

5.4 Project Management

Sound project management techniques should be used to ensure that construction is carried out in an effective and efficient manner. The Project Manager's responsibilities include the following:

a) That the planning, co-ordination and implementation of a construction project is carried out in an efficient manner and in accordance with the requirements of any regulatory authority having jurisdiction.
b) That the necessary permits and approvals are obtained from any regulatory authority.
c) That any specific requirements of any permit or approval are complied with in all respects throughout the duration of the construction project.
d) That any specific requirements of any person or any agency which has provided a utility right-of-way are complied with in all respects.
e) That construction of the project is carried out in accordance with all applicable design plans, contract documents and crossing agreements.
f) That any damage to land and/or property is minimized as far as is practical and all such damage is recorded fully and subsequently repaired to the reasonable satisfaction of the owner of that land or property and in accordance with any applicable surface rights or environmental legislation.
g) That procedures used for crossing of foreign pipelines and cables comply with the requirements of the owners of the foreign pipelines and cables.
h) That suitable quality assurance procedures are developed and implemented for the handling, storage and installation of all materials.
i) That construction procedures used for the project are in conformance with all applicable codes and standards, the specific requirements of any regulatory authority, and the correct technical interpretation of the specifications in any contract between the distributor and the person undertaking the construction project.
j) That suitable testing procedures are utilized to qualify any person who will be engaged in welding of steel pipelines, high energy joining of aluminum pipelines, and fusion of polyethylene pipelines.
k) That all requirements of legislation and standards involved in the construction project are complied with.
l) That the location of all distribution pipelines and plant, and the location of all above ground appurtenances, are accurately recorded and appropriate information is forwarded to Alberta One-Call.
and
m) That landowners are satisfied that rights-of-way have been cleaned up and restored,

"**plant**" means a pipeline (including any equipment, apparatus, mechanism, machine or instrument incidental to the operation of a pipeline) that:

- Is part of a rural gas utility, and
- Is dedicated to supplying gas to that portion of a franchise area that is annexed by an urban municipality.

5.5 Right-of-Entry and Crossing

Before any construction takes place, the approval of an owner or administrator whose land, property or facility is to be crossed must be obtained. The right to enter or to cross must be in written form, such as for:

a) Private Land: A utility right-of-way or similar instrument (e.g., caveat) which can be registered against the appropriate land title (e.g. used for right-of-entry to private lands).
b) Registered Rights-of-Way: A legal agreement (e.g., a plan) used for crossings of roads, foreign pipelines, railways, etc.
c) Public or Crown Land: Written authorization, or a notification to a person who is empowered to exercise that authority (e.g. used for crossing of watercourse, right-of-entry to Crown lands, etc.).

5.6 Pipeline Joining

5.6.1 Welding of Steel or Aluminum Pipe

Welding of joints in steel or aluminum pipelines must comply with the requirements of any applicable CSA standards, the AER and Alberta Municipal Affairs. All personnel handling and storing explosives must comply with the Provincial and Federal Acts and Regulations regarding explosives.

Only the person performing high-energy joining is required to be qualified in accordance with CSA Z662 requirements and provincially approved procedures.

5.6.2 Joining of Reinforced Thermoplastic Pipe

Joining must be performed by trained personnel and equipment approved by the manufacturer and/or equipment supplier and in compliance with Clause 13 of CSA Z662.

5.6.3 Fusion of Polyethylene Pipe

A person who intends to carry out fusion of polyethylene pipe must be trained and certified by an agency approved by Chief Officer and must produce a current and valid certificate (ticket) upon request by a Rural Utilities representative.

An agency shall be approved by the Chief Officer to provide training and certification by demonstrating that it has the equipment, facilities, suitable trainer(s) and programs for certifying and recertifying candidates.

In order to obtain certification, a candidate must demonstrate by examination:

a) Comprehensive knowledge of polyethylene pipe installation and safety practices,
b) The ability to discriminate between poor and acceptable fusions,
c) The ability to join all sizes of pipe utilized by the distributor, and
d) The proficiency to consistently make acceptable fusions using conventional or electrofusion equipment.

Certification is valid for two years.

Only those materials, fittings, equipment and methods that are permitted in applicable CSA Standards and recommended by the manufacturer of the pipe material which is to be joined should be used in polyethylene pipe fusions.

A fusion procedure should be used for polyethylene pipe joining whenever possible. Mechanical fittings or electrofusion is recommended for fusing dissimilar polyethylene materials. Heat fusion shall not be used, unless their compatibility has been proven by test.

> The pocketbook sized "Polyethylene Fusion Guide for Gas Distribution Pipe" (the latest edition) developed with consultation of a number of utility companies and training agencies is recommended only as reference to all persons who intend to perform polyethylene pipe fusions.

Note that joining of polyethylene pipe intended to operate over 700 kPa must be performed in accordance with Clause 13 of CSA Z662, and that piping over 700 kPa is under the jurisdiction of the AER.

5.7 Pipeline Installations

Distribution pipelines should be installed in accordance with sound engineering practice and in accordance with the CSA Z662 Standard. Care should be taken to avoid excessive stresses when using a plough as the minimum radius of pipe curvature caused by the plough chute shall not be less than the minimum recommended by the pipe manufacturer. When pipe is to be installed where rock is present, special care must be taken to bed the pipe in a protective material such as sand (see Figure 5.1).

In cold weather conditions, whether uncoiling, ploughing or fusing polyethylene pipe, the distributor should consult the pipe manufacturer for specific installation procedures.

5.8 Surface Installations

Temporary pipeline installations of distribution polyethylene pipe may be made on the surface of the ground provided that adequate precautions are taken to prevent damage to the pipeline and to ensure the safety of the public.

These installations require notification and approval by the Chief Officer. The distributor (or pipeline owner) must be able to demonstrate that the surface installation is necessary and will be protected from damage during the period that it is in service. Warning signs should be installed at specific distances to clearly identify the existence of the gas pipeline. The Chief Officer may also request other precautions and notification of when the service installation has been removed.

Any surface installations of high-pressure steel or aluminum pipelines require the prior approval of the AER.

5.9 Warning Signs

Where a pipeline is buried below a highway, road, railway, canal or watercourse, a suitable warning sign should be permanently installed inside but within 300 mm of the edge of each side of the right-of-way to identify the existence of the buried pipeline. Temporary warning signs should be used during construction while crossing facilities such as foreign pipelines or other utilities where permanent signs are impractical.

The design of the warning sign and the material used should meet the intent of the most recent edition of the CSA Z662 Standard. Warning signs for high-pressure pipelines and installations must meet the requirements of the AER.

Warning signs should be installed within 60 days of completion of construction or within a lesser period if clear evidence of construction no longer exists. Signs should be installed beside buried pipe without causing damage to the pipeline.

5.10 Domestic Meter Installations

Domestic meter installation should be installed in a manner (such as the use of swing joints) that will avoid excessive stress on the meter, piping and ancillary equipment. The location of domestic meter sets should, if possible, be outside buildings. When necessary, outside meters and regulators should be protected.

Care should be taken to ensure that vented gas from relief valves can escape freely to the atmosphere and not be drawn inside the building through vents (see Figure 5.2). Meters shall be installed in readily accessible locations when outside buildings and reasonable protection from damage shall be provided. A typical domestic meter set is illustrated in Figure 5.3, while a typical riser assembly upstream of the meter set is shown in Figure 5.4.

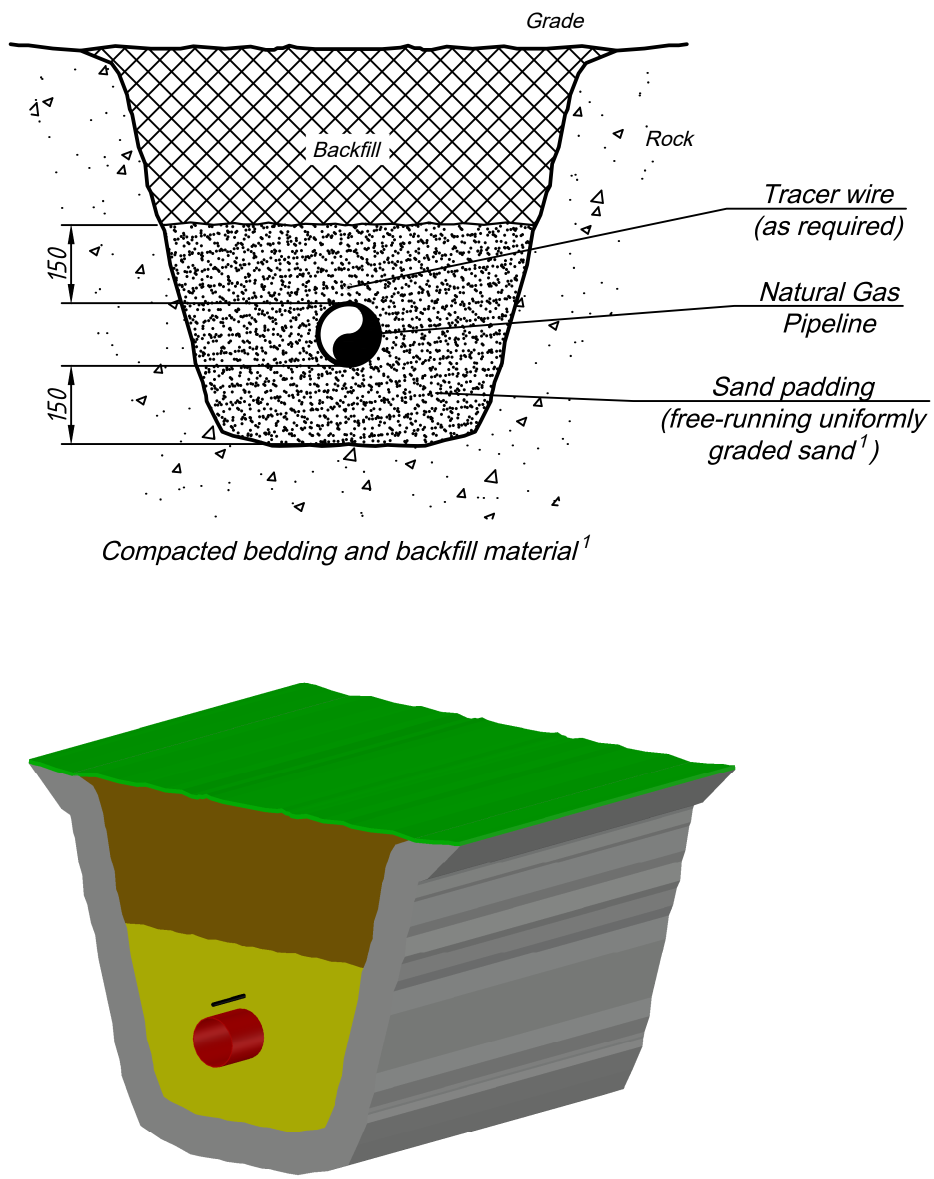
5.11 Cathodic Protection

Pipelines and appurtenances that are subject to corrosion due to electrochemical conditions (such as exposure to power lines) must be adequately protected from such corrosion and should be designed and installed by a person qualified in that field.

As per CSA Z662, steel distribution systems shall be protected against external corrosion. In the field, steel pipelines must be cleaned and coated with a suitable protective coating that is specifically manufactured for that purpose and bonded to the pipeline by recognized methods, as per CSA Z245.30 (Field-Applied External coatings for Steel Pipeline Systems). Where connection of dissimilar materials occurs in a pipeline system, or where it is necessary to electrically isolate individual sections of a pipeline and the cathodic protection system, the connections or isolation points must be made with suitable insulation fittings or flanges specifically designed and manufactured for that purpose.

Installation of a cathodic protection system should be completed with the installation of the pipeline system to be protected.

A typical cathodic protection test station and anode installation is illustrated in Figure 5.5



[1] as per utility specifications

FIGURE 5.1 TYPICAL CROSS SECTION FOR SAND-PADDED ROCK DITCH

NOTES:

1. Owner may specify the grading requirements of the sand padding.

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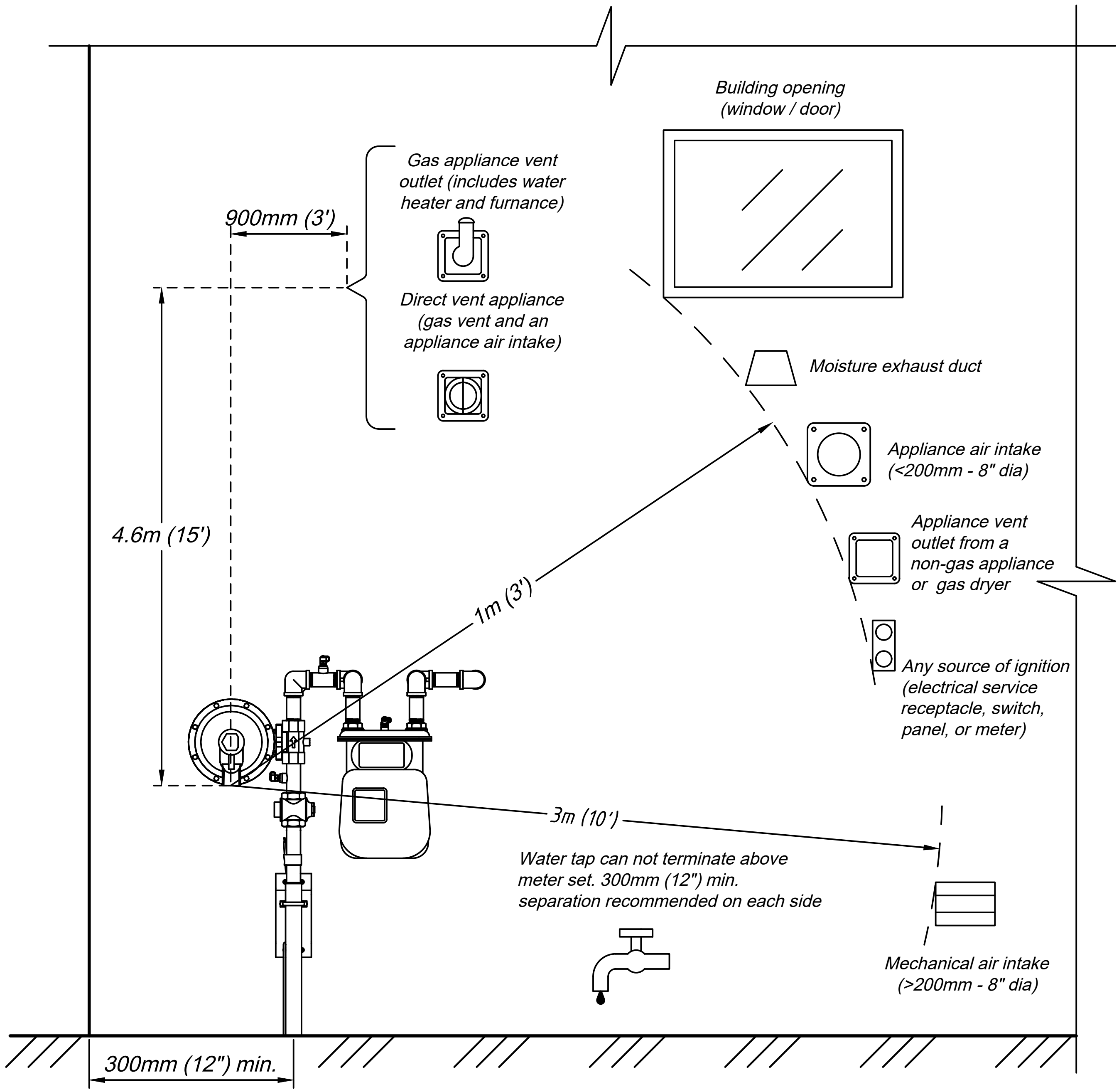

FIGURE 5.2 **LOCATION OF REG. VENT RELATIVE TO BUILDING OPENINGS**

NOTES:

1. All clearances listed are in accordance with CSA B149.1;
2. If these clearances cannot be met, CSA 6.22 regulator/relief may be used. See table 5.2 in CSA B149.1 for acceptable clearances.

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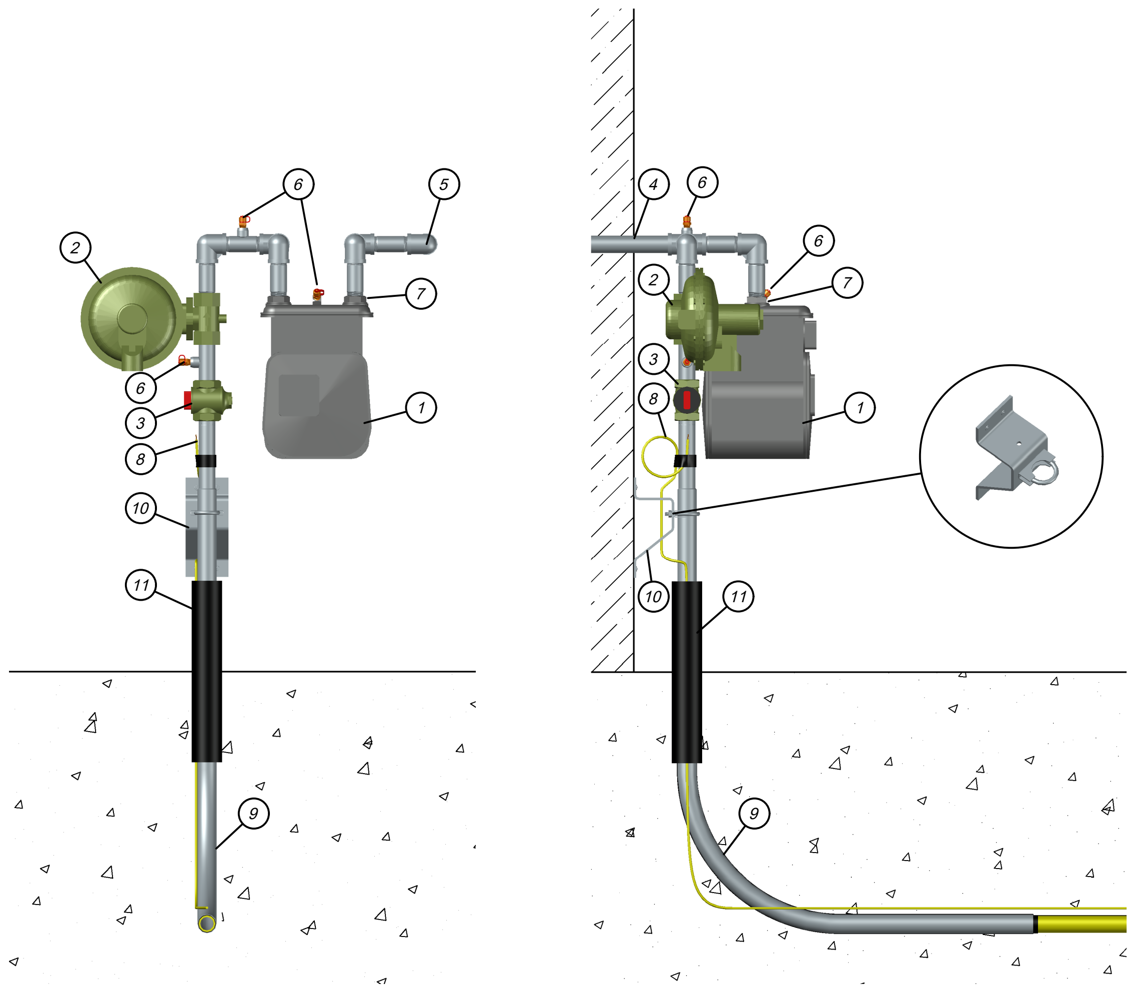

Table 1

Item №	Description
1	Domestic meter
2	Regulator c/w internal relief valve
3	Insulated lubricated plug valve
4	Building inlet piping
5	Threaded elbow
6	* Test point (PFM set)
7	Insulated meter swivel
8	Tracer wire
9	Anodeless riser
10	Support bracket
11	Pipe sleeve

* Optional for 1.7 kPag (4 oz/in², 0.25 psig) meter sets

FIGURE 5.3 TYPICAL DOMESTIC / PFM METER SET

NOTES:

1. Swing joints should be considered for installation to minimize strain on the meter connections;
2. Tracer wire needs to be secured to riser with the ends terminated appropriately;
3. On PFM installations, a second low-pressure regulator may be required downstream of the meter;
4. A pressure tap must be located within 460 mm (18 in) of th PFM regulator inlet

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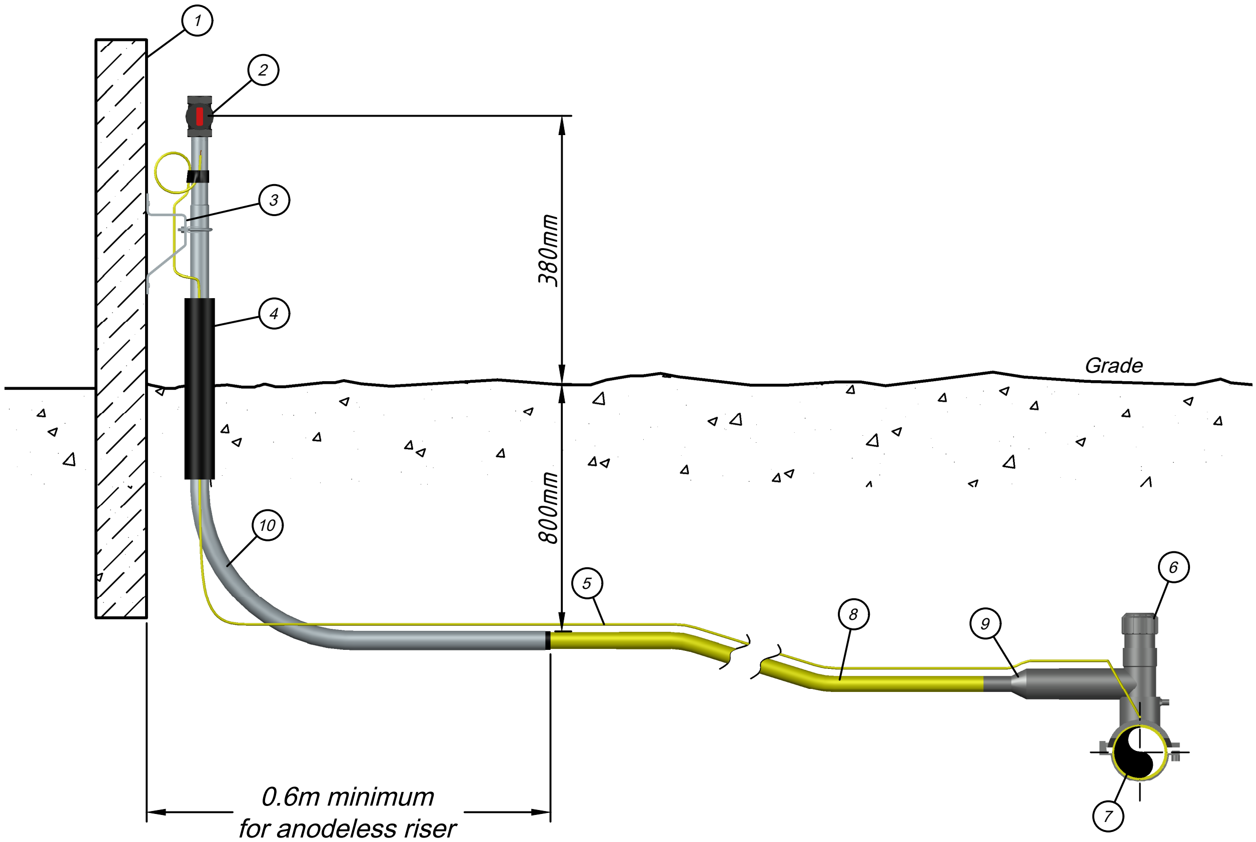

Table 1

Item №	Description
1	Concrete foundation wall
2	Insulated Meter valve
3	Support bracket
4	Pipe sleeve
5	Tracer wire

6	Service tee
7	PE main
8	PE service line
9	Reducer
10	Anodeless riser

FIGURE 5.4 TYPICAL RISER ASSEMBLY

NOTES:

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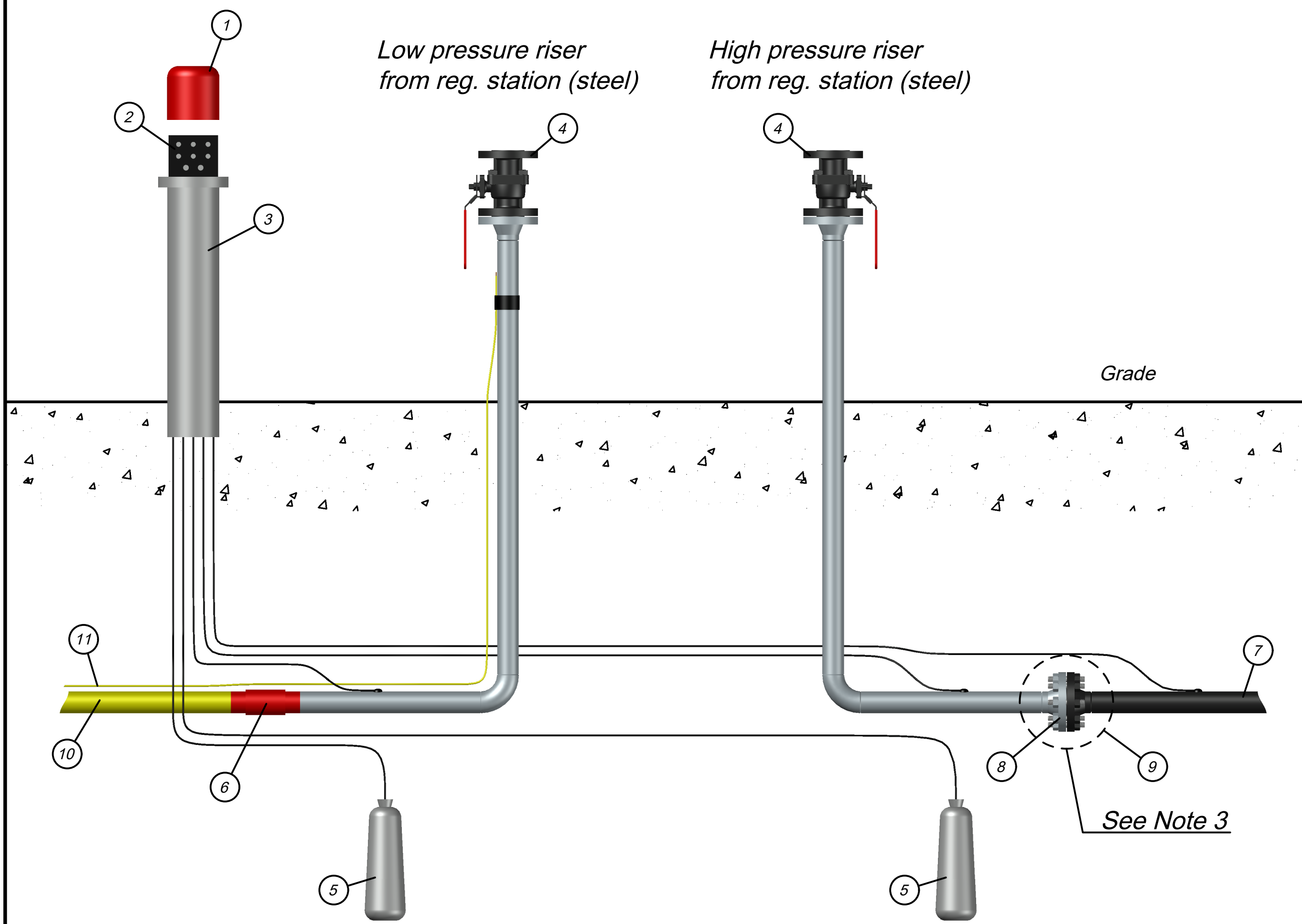

Table 1

Item №	Description
1	Terminal cover
2	Test terminal
3	Plastic lead post
4	Valve
5	Anode
6	Transition fitting from plastic to steel
7	Aluminum pipe
8	Insulating kit
9	Prefabricated transition piece
10	Polyethylene pipe
11	Tracer wire

FIGURE 5.5 TYPICAL TEST STATION C/W ANODE INSTALLATION

NOTES:

1. Cadwelding should not be carried out when pipeline is pressurized;
2. The high pressure riser may be a CSA approved aluminum component provided it is insulated from steel apparatus;
3. Alternatives to the use of below grade flanges should be considered in frost heave locations.

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6. Regulator Stations and Isolation Valve Assemblies

6.1 General

The number, type and location of regulator stations and isolation valve assemblies in a distribution system should be subject to very careful design considerations since these facilities are critical to the successful operation of the entire distribution system. The location of these facilities is of principal concern since regulator stations and isolation valve assemblies should be accessible for year-round maintenance and operation, and should be on a high point of the pipeline and the terrain through which the pipeline is to be installed (i.e. to minimize site flooding or ground conditions requiring increased pipe depth)

Each facility should be provided with:

a) Adequate structural support to prevent excessive stress on station and inlet/outlet piping.
b) A protective railing or fence to prevent damage from farm or other machinery.
c) Security measures to prevent unauthorized operation of valves and other equipment.
d) Where appropriate, a suitable protective housing to prevent malfunction of control devices due to inclement weather conditions and to prevent accelerated corrosion of such devices.

6.2 Regulator Stations

A wide variety of design and equipment options exist for regulator stations to suit the specific requirements of the downstream distribution system, which is being served. In selecting from these options, the designer should attempt to carefully balance the layout and equipment needed to facilitate sound operational maintenance of the station.

For pressure regulator stations, sufficient ancillary fittings to provide for pressure gauges, swing joints, relief valves and accounting meters should be included. The selection of the number and type of pressure regulators should also take into account manufacturers' recommendations and specifications for pressure and volume flow, as well as the number and type of consumers in the downstream system and the pressure and volume flow requirements for that system. Pressure rating of piping and equipment should be suitable for the application.

For over pressure control requirements, one time use pop-style reliefs shall not be incorporated.

Although the services of qualified gas distribution professional recognized by the *Engineering and Geoscience Professions Act* are required for engineering drawings, the recommended layouts and components for the four basic design options are illustrated in the following figures:

Figure 6.1 - single run, single cut design	Figure 6.2 - single run, double cut design
Figure 6.3 - double run, single cut design	Figure 6.4 - double run, double cut design

It is also recommended that provisions be made for accounting meters in all regulator station designs.

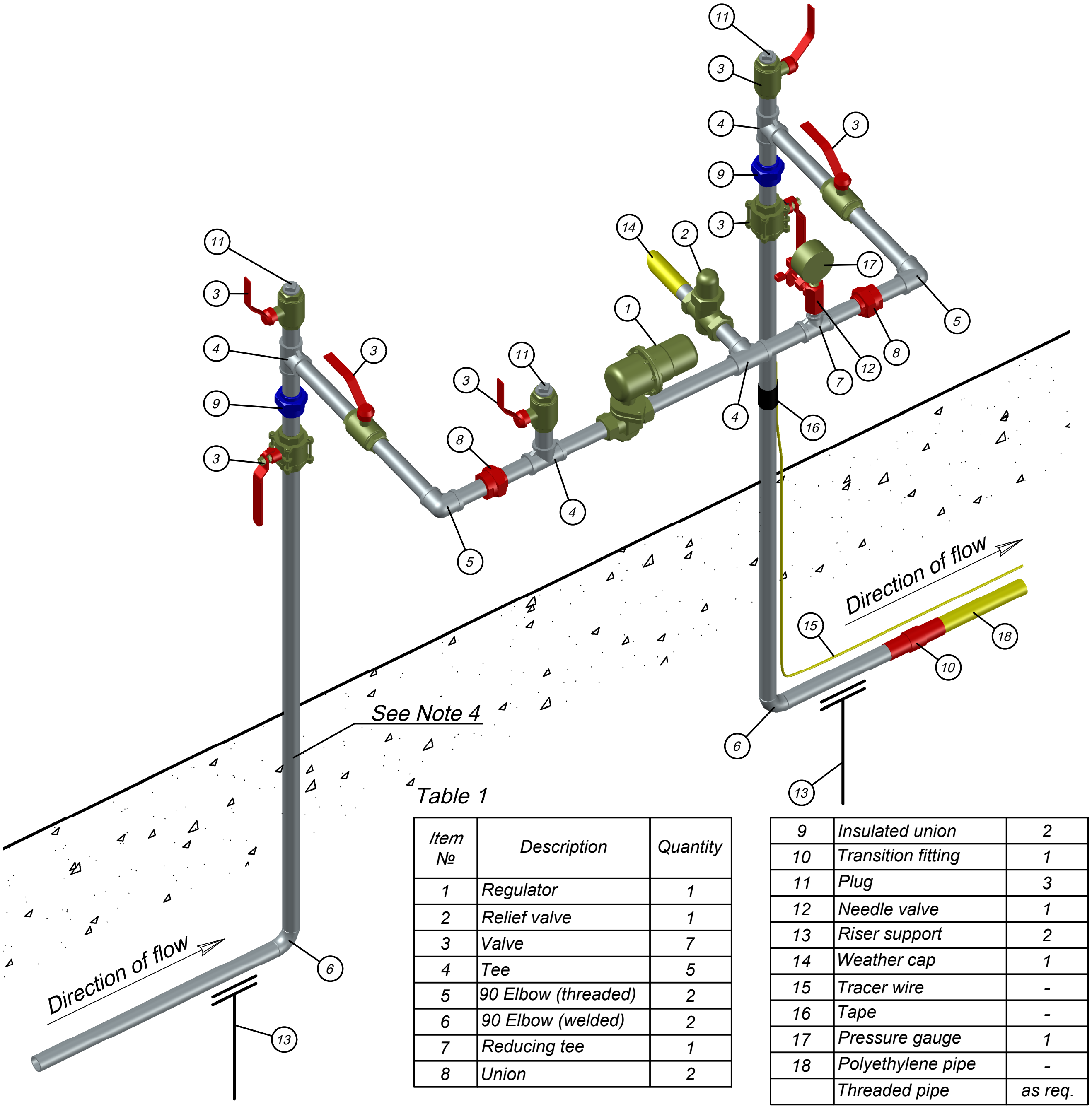

Table 1

Item №	Description	Quantity
1	Regulator	1
2	Relief valve	1
3	Valve	7
4	Tee	5
5	90 Elbow (threaded)	2
6	90 Elbow (welded)	2
7	Reducing tee	1
8	Union	2
9	Insulated union	2
10	Transition fitting	1
11	Plug	3
12	Needle valve	1
13	Riser support	2
14	Weather cap	1
15	Tracer wire	-
16	Tape	-
17	Pressure gauge	1
18	Polyethylene pipe	-
	Threaded pipe	as req.

FIGURE 6.1 TYPICAL SINGLE RUN, SINGLE CUT REGULATOR STATION

NOTES:

1. It is recommended that provision be made for accounting meters in all designs;
2. On enclosed regulator stations, relief venting must be vented to atmosphere;
3. Riser support should be considered;
4. Buried piping shall be protected from supports/damage and all bore metal should be coated and/or taped.

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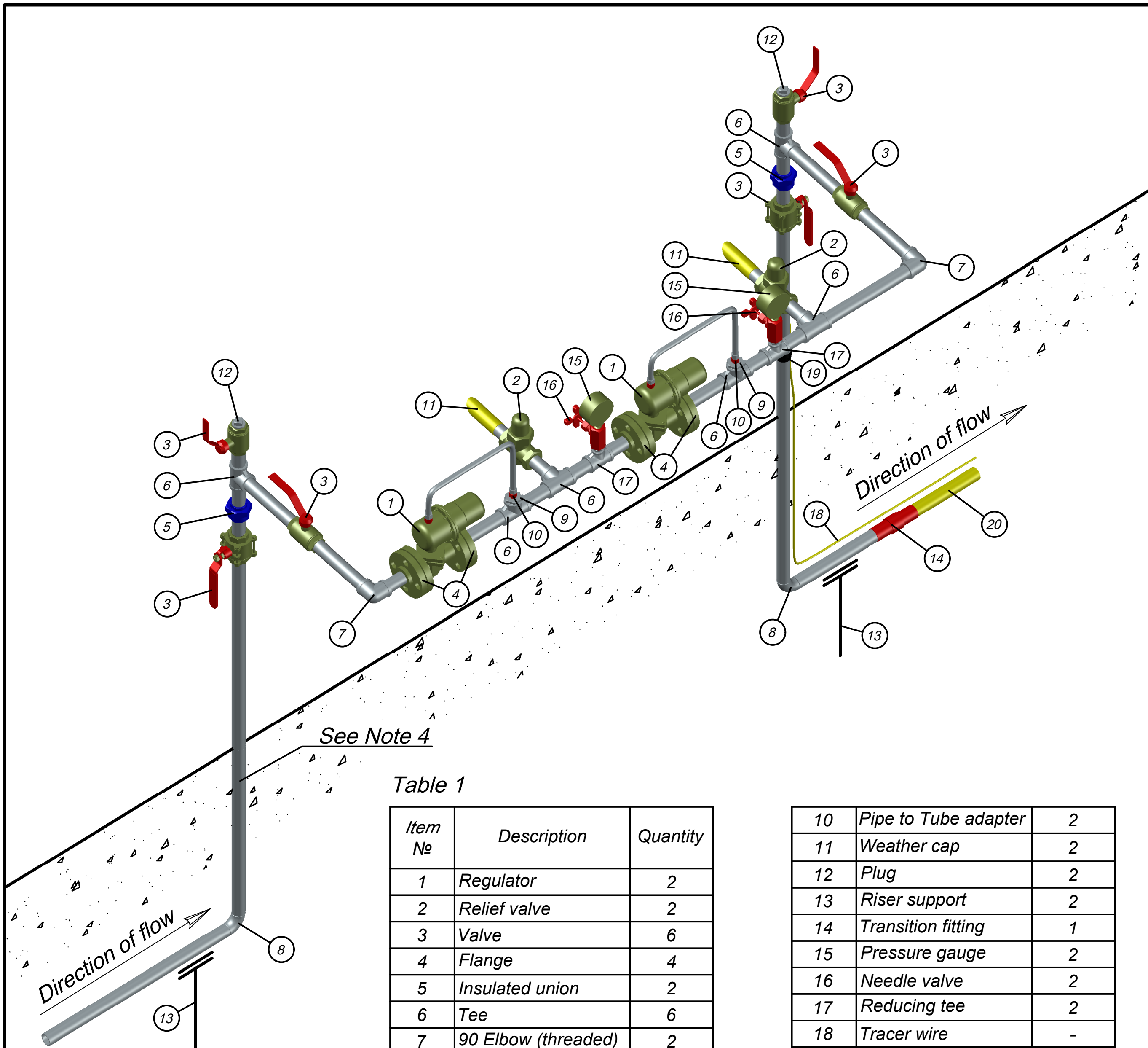

Table 1

Item №	Description	Quantity
1	Regulator	2
2	Relief valve	2
3	Valve	6
4	Flange	4
5	Insulated union	2
6	Tee	6
7	90 Elbow (threaded)	2
8	90 Elbow (welded)	2
9	Reducing bushing	2
10	Pipe to Tube adapter	2
11	Weather cap	2
12	Plug	2
13	Riser support	2
14	Transition fitting	1
15	Pressure gauge	2
16	Needle valve	2
17	Reducing tee	2
18	Tracer wire	-
19	Tape	-
20	Polyethylene pipe	-
	Threaded pipe	as req.

FIGURE 6.2 TYPICAL SINGLE RUN, DOUBLE CUT REGULATOR STATION

NOTES:

1. It is recommended that provision be made for accounting meters in all designs;
2. On enclosed regulator stations, relief venting must be vented to atmosphere;
3. Riser support should be considered;
4. Buried piping shall be protected from supports/damage and all bore metal should be coated and/or taped.

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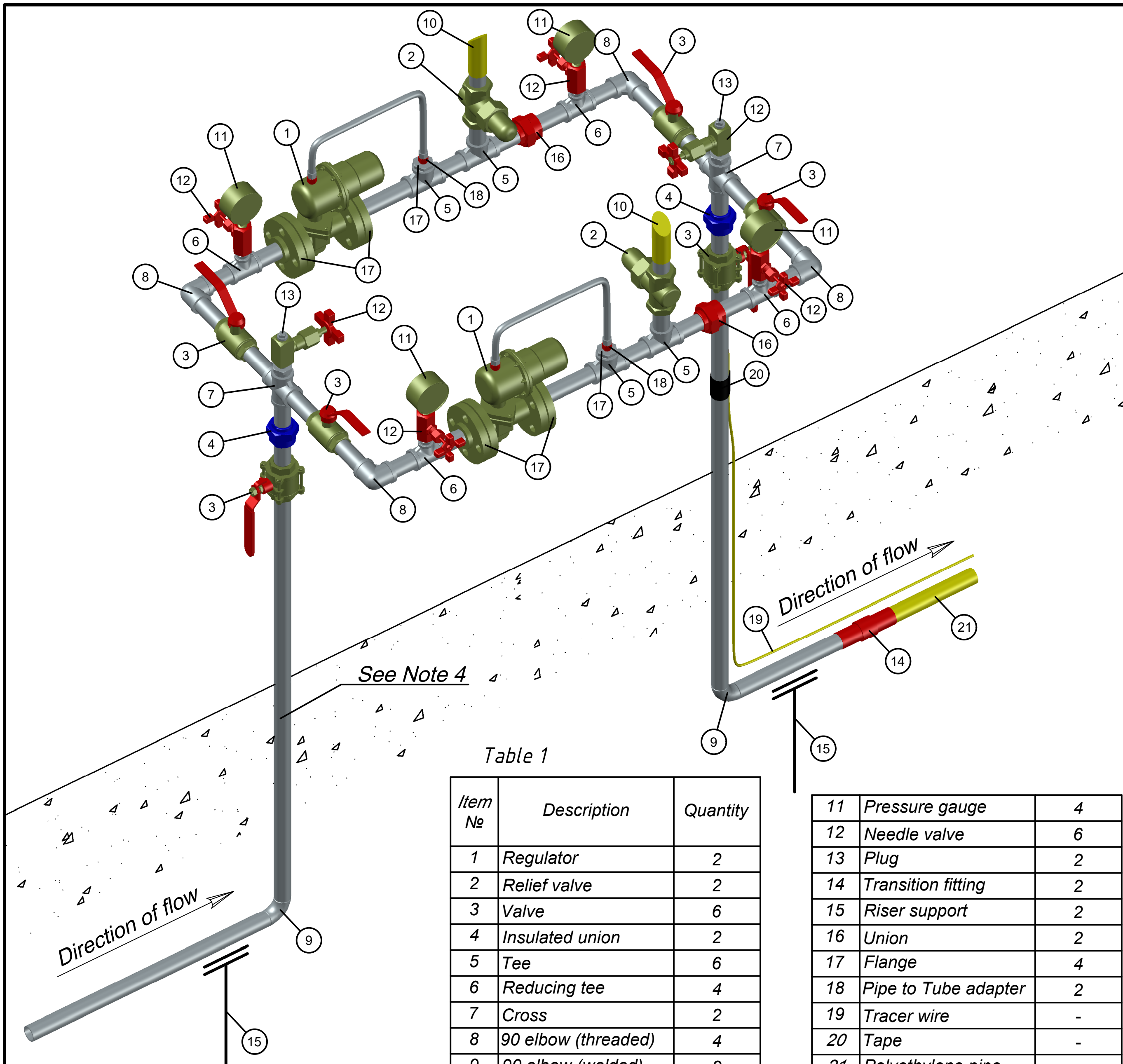

Table 1

Item №	Description	Quantity
1	Regulator	2
2	Relief valve	2
3	Valve	6
4	Insulated union	2
5	Tee	6
6	Reducing tee	4
7	Cross	2
8	90 elbow (threaded)	4
9	90 elbow (welded)	2
10	Weather cap	2
11	Pressure gauge	4
12	Needle valve	6
13	Plug	2
14	Transition fitting	2
15	Riser support	2
16	Union	2
17	Flange	4
18	Pipe to Tube adapter	2
19	Tracer wire	-
20	Tape	-
21	Polyethylene pipe	-
	Threaded pipe	as req.

FIGURE 6.3 TYPICAL DOUBLE RUN, SINGLE CUT REGULATOR STATION

NOTES:

1. It is recommended that provision be made for accounting meters in all designs;
2. On enclosed regulator stations, relief venting must be vented to atmosphere;
3. Riser support should be considered;
4. Buried piping shall be protected from supports/damage and all bore metal should be coated and/or taped.

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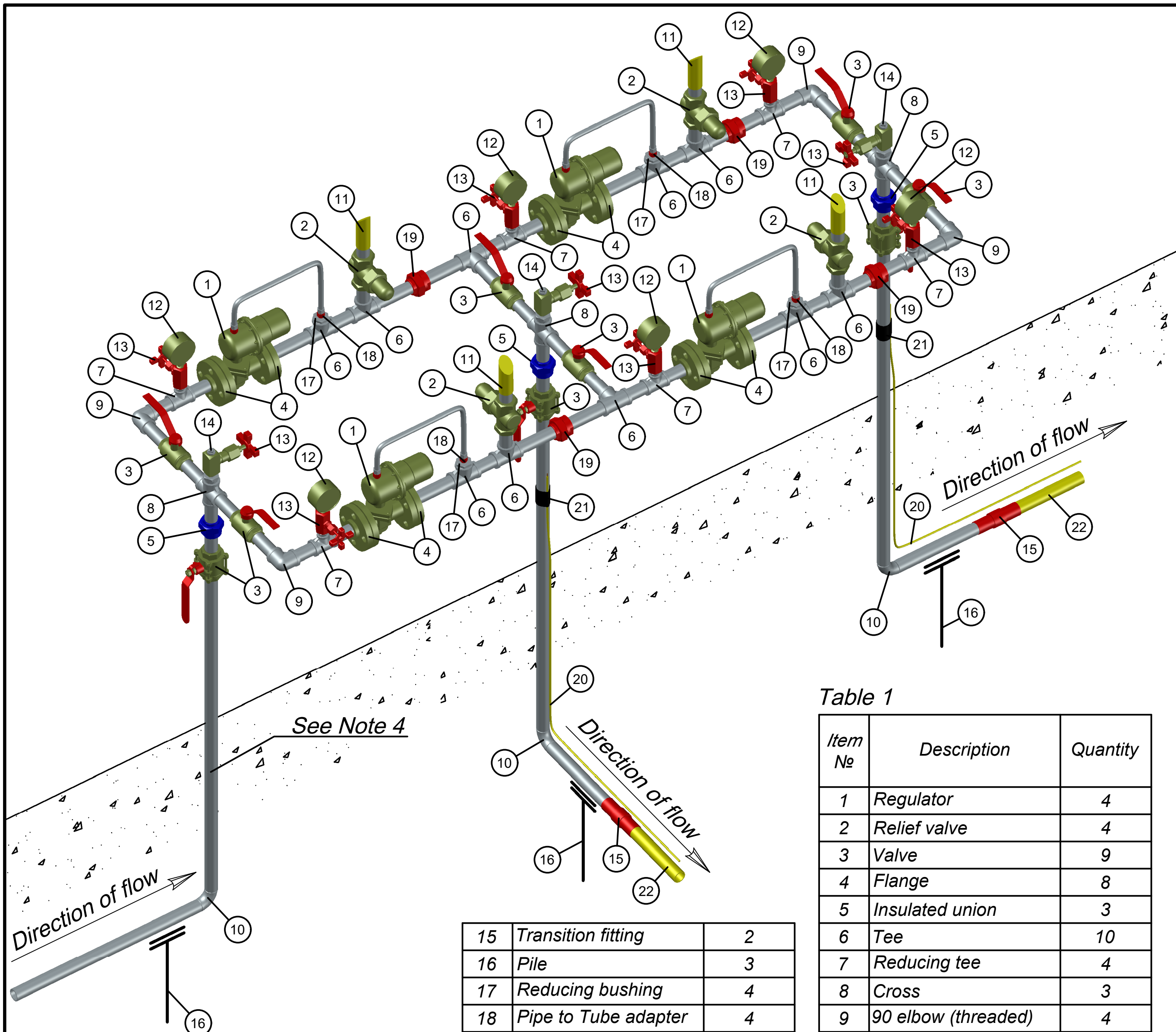

Table 1

Item №	*Description*	*Quantity*
1	*Regulator*	*4*
2	*Relief valve*	*4*
3	*Valve*	*9*
4	*Flange*	*8*
5	*Insulated union*	*3*
6	*Tee*	*10*
7	*Reducing tee*	*4*
8	*Cross*	*3*
9	*90 elbow (threaded)*	*4*
10	*90 elbow (welded)*	*3*
11	*Weather cap*	*4*
12	*Pressure gauge*	*6*
13	*Needle valve*	*9*
14	*Plug*	*3*

15	*Transition fitting*	*2*
16	*Pile*	*3*
17	*Reducing bushing*	*4*
18	*Pipe to Tube adapter*	*4*
19	*Union*	*4*
20	*Tracer wire*	*-*
21	*Tape*	*-*
22	*Polyethylene pipe*	*-*
	Polyethylene pipe	*as req.*

FIGURE 6.4 TYPICAL DOUBLE RUN, DOUBLE CUT REGULATOR STATION

NOTES:

1. It is recommended that provision be made for accounting meters in all designs;
2. On enclosed regulator stations, relief venting must be vented to atmosphere;
3. Riser support should be considered;
4. Buried piping shall be protected from supports/damage and all bore metal should be coated and/or taped.

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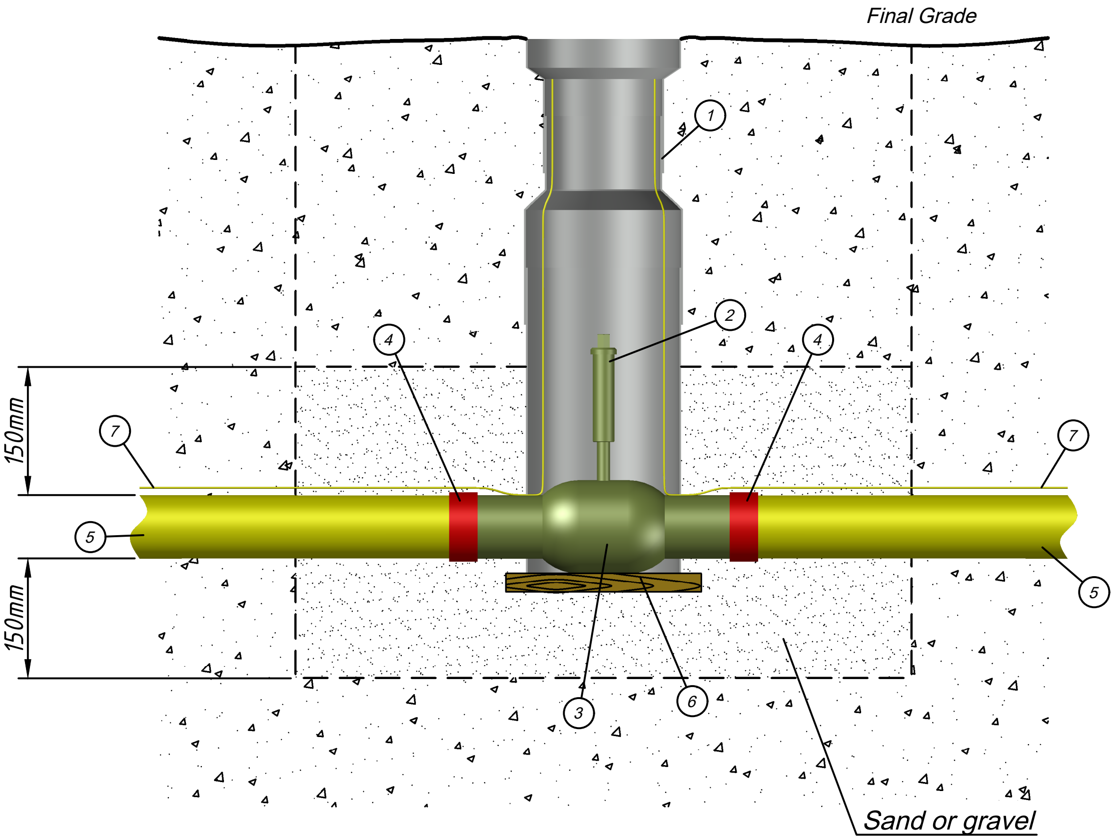
6.3 Isolation Valve Assemblies

Isolation valves should be strategically located to permit damaged or ruptured segments of a distribution system or pipeline to be isolated for repair without the need to shut down the entire distribution system. The designer must exercise considerable judgment in selecting the best locations on the system for this purpose, taking into account the type of pipeline, the number and type of consumers who would be isolated from the supply (such as hospitals), the line-pack capability of the downstream system, and the physical terrain conditions.

"**Line pack**" refers to the volume of gas that can be "stored" in a gas pipeline.

In the case of polyethylene systems, greater flexibility exists in system isolation through the use of squeeze-off tools since the isolated segment can be restricted. However, cold weather conditions and/or the type and size of polyethylene material used may not be sufficiently resilient to withstand the stresses imposed by the squeeze-off procedure, and the use of isolation valves may be preferable in these cases.

Typical design layouts for both underground and above ground assemblies are illustrated in Figures 6.5 to 6.8 inclusive.



Item №	Description
1	Valve box c/w extention head
2	Valve key/grease nipple extension
3	Polyethylene valve
4	Polyethylene coupling
5	Polyethylene natural gas pipeline
6	Treated wood plank/concrete pad
7	Tracer wire

FIGURE 6.5 TYPICAL UNDERGROUND POLYETHYLENE ISOLATION VALVE ASSEMBLY

NOTES:

1. Marker post to be placed within reasonable proximity to the valve assembly w/o obstructing access;
2. Sand pad above pipe as required;
3. Concrete pad on well compacted subgrade may be needed for larger valves.

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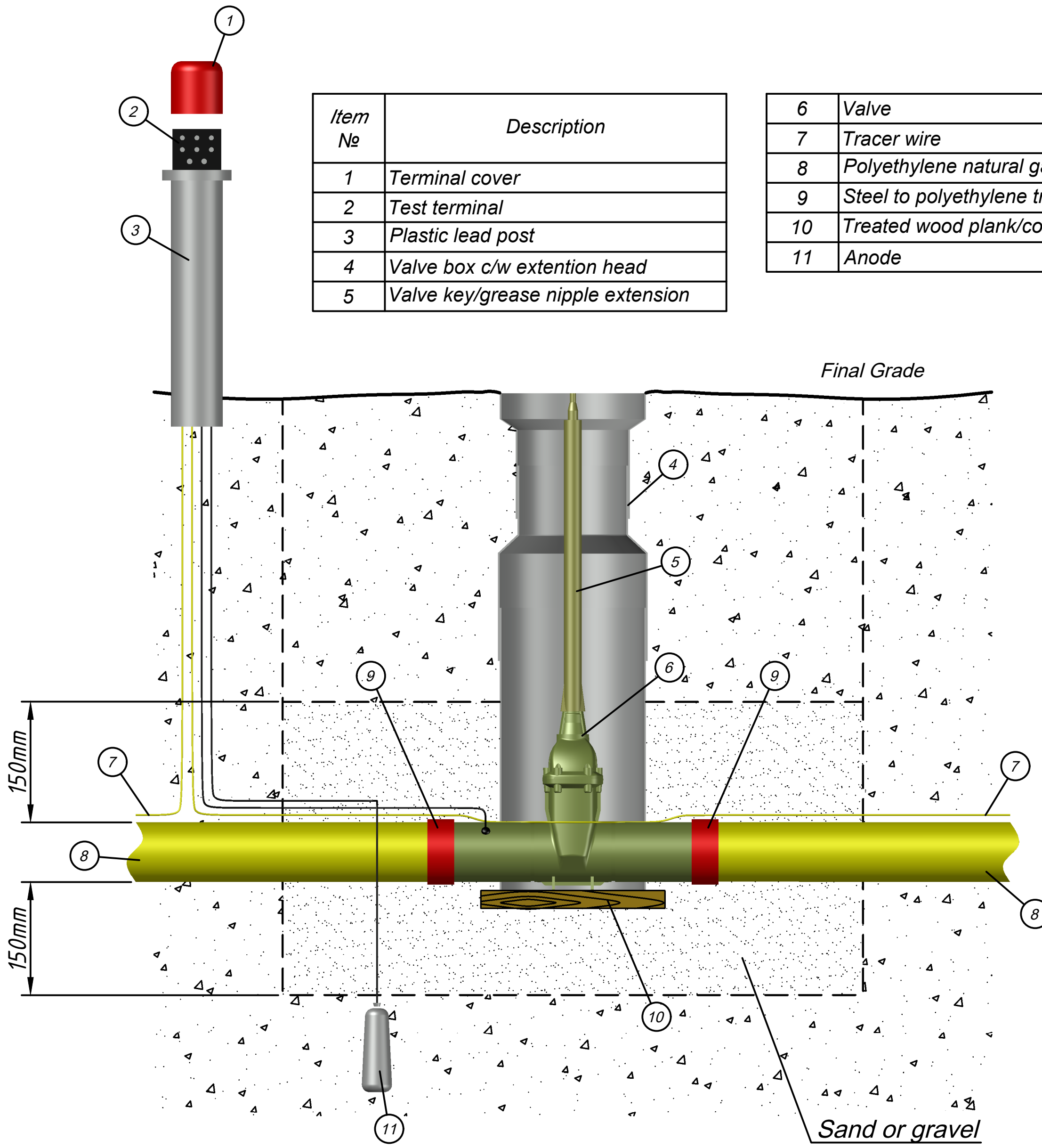

Item №	Description
1	Terminal cover
2	Test terminal
3	Plastic lead post
4	Valve box c/w extention head
5	Valve key/grease nipple extension
6	Valve
7	Tracer wire
8	Polyethylene natural gas pipeline
9	Steel to polyethylene transition fitting
10	Treated wood plank/concrete pad
11	Anode

FIGURE 6.6 TYPICAL UNDERGROUND STEEL ISOLATION VALVE ASSEMBLY

NOTES:

1. Marker post to be placed within reasonable proximity to the valve assembly w/o obstructing access;
2. Sand pad above pipe as required;
3. Concrete pad on well compacted subgrade may be needed for larger valves.

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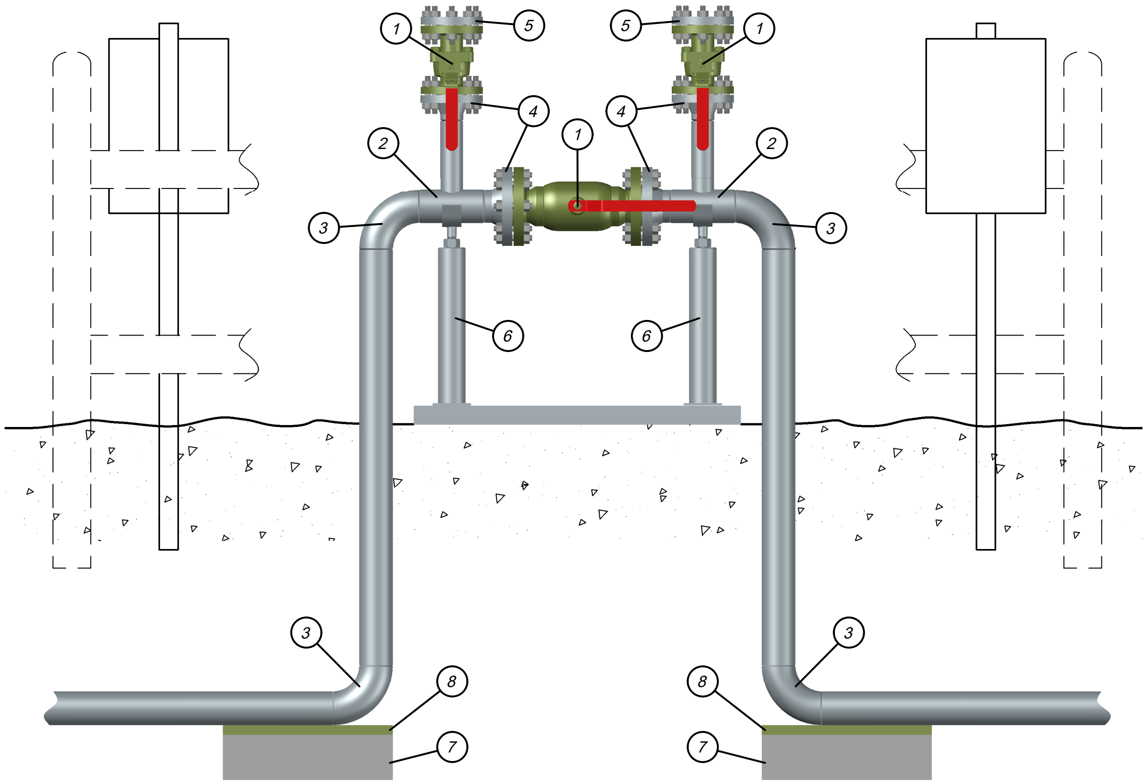

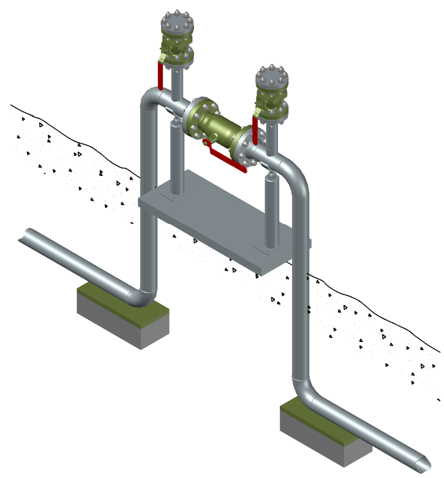

Item №	Description
1	Valve
2	Standard butt weld tee
3	90 LR standard butt weld elbow
4	Weld neck flange & gasket
5	Blind flange & gasket
6	Adjustable pipe saddle support
7	Riser support
8	Padding / Rockshield

FIGURE 6.7 TYPICAL ABOVE GROUND STEEL ISOLATION VALVE ASSEMBLY

NOTES:

1. 90° Risers may restrict in line inspections.

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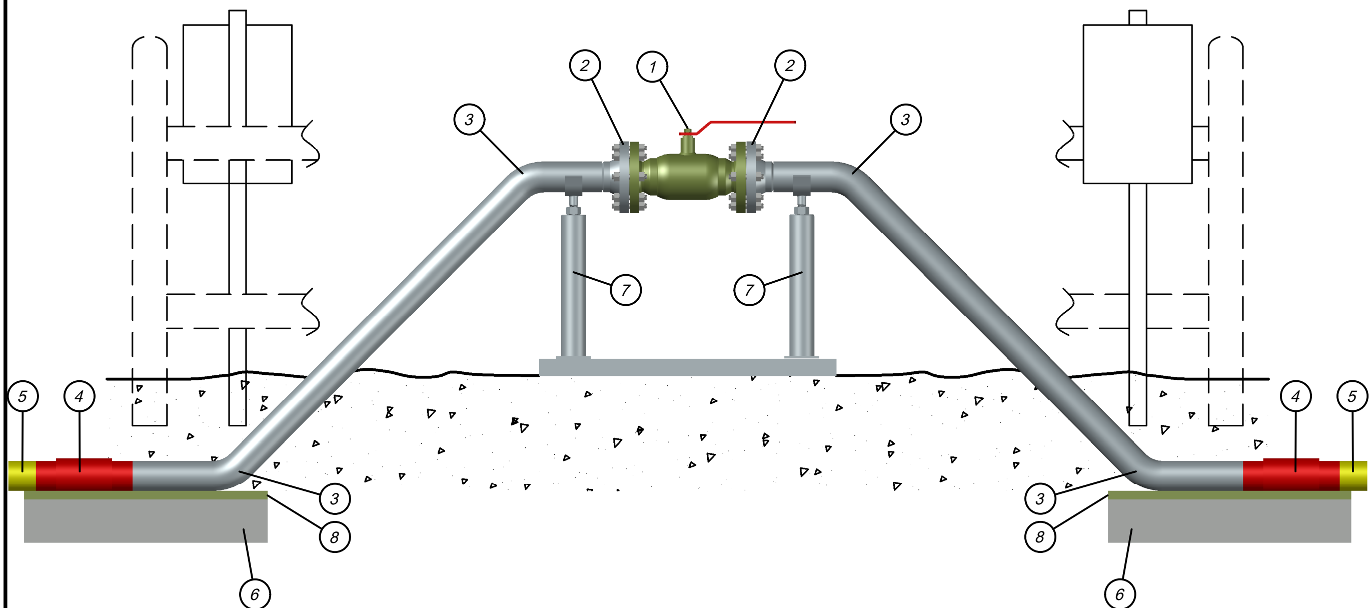

Item №	Description
1	Valve
2	Weld neck flange & gasket
3	45 LR standard butt weld elbow
4	Transition fitting
5	Polyethylene natural gas pipeline
6	Riser support
7	Adjustable pipe saddle support
8	Padding / Rockshield

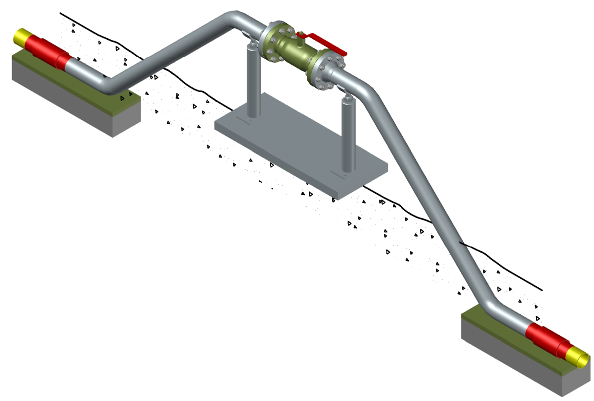

FIGURE 6.8 TYPICAL ABOVE GROUND DISTRIBUTION ISOLATION VALVE ASSEMBLY

NOTES:

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7. Testing and Qualifying of Pipelines

7.1 General

This section covers pressure testing and qualifying of low-pressure pipelines to operate at specific design pressures. Such pipelines will usually be manufactured from plastic materials. For high-pressure pipelines, pressure testing and licensing requirements are prescribed and administered by the Alberta Energy Regulator.

> **"Hoop stress"** is the stress that occurs along the pipe's circumference when pressure is applied. Hoop stress acts perpendicular to the axial direction. Hoop stresses are tensile and generated to resist the bursting effect that results from the application of pressure.

7.2 Maximum Operating Pressures

The maximum operating pressure (MOP) at which a distribution pipeline may operate is derived from a number of factors including material properties, the hoop stress at which the pipe may operate and the use of safety factors.

> "**RTP**" means reinforced thermoplastic pipe.

With respect to new pipeline systems, polyethylene materials currently used in Canada to manufacture gas pipelines are all rated to a maximum "hydrostatic design basis" of 8.62 megapascals (MPa) at 23°C. This is the rating for all medium density pipe. Accordingly, the design formula for polyethylene pipe from the CSA Z662 Standard will derive a MOP of 690 kPa for pipe with a "dimension ratio" (DR) of 11. Note that DR 11 pipe should be used for all polyethylene pipe systems under the scope of this manual unless special design factors, or materials dictate otherwise (i.e. PE100 and RTP systems).

7.3 Pressure Testing

Pressure testing of polyethylene systems should be based on a pressure that is 1.4 times the design MOP and should be in accordance with the requirements of the most recent edition of the CSA Z662 Standard. For example, the recommended test pressure for DR 11 pipe is 980 kPa for all installations even if it is intended to qualify and operate the pipeline system at less than the maximum pressure permitted by CSA Z662 (i.e. Medium Density or <700 kPa (100 Psi) systems).

The duration of a pressure test should be based on the length of the pipeline which is under test following a 30 minute stabilization period after pressurizing. A sample calculation and procedure to develop the spreadsheet will be documented below. The minimum test durations calculated should not be less than that shown in the Table 7.1.

With the advent of digital gauges, when properly calibrated, the requirement for charting can be performed via digital recording devices. These recording devices must be capable of detecting a leak within the guidelines depicted in the test duration calculator. The resulting information must be transferred into paper format and maintained with the other relevant pipeline construction documents for the life of the pipeline.

Table 7.1 – Pressure Recording Test Time Device Chart

Length of Pipeline Under Test	Minimum Test Duration	Recording Device Type
< 100 m, & ≤ 33.4 mm O.D.	30 minutes	Pressure Gauge
< 2000 m, & ≤ 60.3 mm O.D.	4 hours	Chart/Digital
< 6000 m, & ≤ 60.3 mm O.D.	12 hours	Chart/Digital
< 12000 m, & ≤ 60.3 mm O.D.	24 hours	Chart/Digital
< 5500 m, & ≤ 88.9 mm O.D.	24 hours	Chart/Digital
< 3200 m, & ≤ 114.3 mm O.D.	24 hours	Chart/Digital

7.3.1 Test Duration Calculator

To aid in calculating project test time, distributors may develop a spreadsheet that can generate results to determine the test duration (in hours) based on the length of pipe being put under test and/or determines the maximum length of pipeline(s) based on the duration of a pressure test.

The image below is a spreadsheet created by Rural Utilities to calculate the duration required for a pressure test in a gas distribution system. In the image, information has been color-coded as follows:

- Textual descriptions are depicted with white backgrounds.
- Yellow cells are data entry locations.
- Blue cells are standard conditions for the calculations, which were utilized to develop the minimum test durations in Table 7.1.
- Green cells perform some intermediate calculations used to generate the end results.
- Orange cells calculate the end results for test duration and max length per test duration.

Spreadsheet for calculating duration for multiple sizes and lengths test

B	C		E	
Pipe Talley	*Input Table*			
Nominal sizes	OD mm	DR	Quantity (M)	4
20PE - 3/4"	26.7	11		
25PE - 1"	33.4	11		
32PE -11/4"	42.2	10		
38PE - 11/2"	48.3	11		
50PE - 2"	60.3	11	2000	
75PE - 3"	88.9	11		
100PE - 4"	114.3	11		
	Internal Volume (M^3) -		3.82	
			Acceptable standard base conditions	12
Base Pressure (psi)	14.73	14.73		
Max. Press. Loss (psi)	3.0	3.0		
Acceptable Loss Rate (cfh)	7.0	7.0		
Test Duration (hr.)	3.9	(236 minutes)		20

Quick Conversions:	*FEET*	to	*METRES*	
			0	24
	KPA	to	*PSI*	
			0	

Spreadsheet for calculating Max. length of line for specific Size & Duration.

	J	
	Input Table	
Pipe O.D. (mm)	60.3	
SDR	11	
Test Pressure (psig)	112	
Base Pressure (psi)	14.73	
Atmospheric Pressure (psi)	13.60	
Duration (hr.)	4	
Max. Press. Loss %	2.7%	Acceptable standard base conditions
Max. Press. Loss (psi)	3.0	
Acceptable Loss Rate (cfh)	7.0	
Max Length (M)	2036	

Notes: 1. Data can only be entered in the yellow shaded areas
2. Input areas have mixed units to accommodate the norm for equipment in the field; conversion table is available for use where alternate units are required.
3. This spreadsheet is designed to calculate max. test durations for systems proposed to operate at 552 kPa (80 psi)

The calculations at the bottom of the page (Quick Conversions) can be used for length or pressure conversions from imperial to metric.

The specific formulas for the spreadsheet are as follows, using the spreadsheet coordinates (column letters and row numbers) in the image as guides to the correct cells to encode in the spreadsheet. Omit quotations when entering these formulas.

a) Internal volume Cell E11 "=SUMPRODUCT((C4:C10*(1-2/D4:D10)/1000)^2*PI()/4*E4:E10)"
b) Pressure Loss Factor Cell C19 "=C13/C12" _ This cell is hidden in completed spreadsheet
c) Test Duration Cell C20 "=C19*E11*35.31467/C14"
d) Area (ft2) Cell J17 "=(J3*(1-2/J4)/50.8)^2*PI()/144)" _hidden cell
e) Initial Vol in- place Cell J18 "=(J5+J7)/J6*J17*J20/0.3048"_ hidden cell
f) Pressure Loss Factor Cell J19 "=J10/J6" _ hidden cell
g) Max Length Cell J20 "=J11*J8/(J17*J19)*0.3048"
h) Meters Cell E24 "=C24*0.3048"
i) Psi Cell E26 "=C26*0.145"

The test duration spreadsheet, when created, should generate values as shown in the Image of Test Duration Calculator and in Table 7.1.

A record of natural gas distribution system pressure tests shall be made and retained and shall contain at least the following information:

- Distributor name
- Name of qualified employee or contractor performing the pressure test
- Test medium used
- Test pressure
- Test duration
- Location and date of test
- Length, diameter, material, and line pressure of the pipe tested
- Extruder and Reel number

See Appendix C-1 for a “Pipeline Test Confirmation” form that can be used to record pressure test results as well as an example of a label that can be affixed to hardcopy test charts.

7.4 Design Qualification of Low-Pressure Pipelines

Distributors are responsible for maintaining data that identifies the pipe used in their system. This data should include the following for each pipe segment:

- From location and facility code
- To location and facility code
- Length of pipe
- Outside diameter of pipe
- Wall thickness of pipe
- Pipe material
- Type and grade of pipe
- Maximum Operating Pressure (MOP)
- Type of external coating on pipe (if applicable)
- Type of joining used
- Operational status
- Year installed

Current pipeline information system (asset management) codes to be used in conjunction with data collection for new pipeline installations are as shown in Appendix C-2

Pipeline design/testing information for low pressure pipelines which fall within the scope of this manual were historically maintained using the “Pipeline License Application“ form shown in Appendix C-5. The “Historical pipeline information codes” that represent data on pipe previously installed in distribution systems and found in distributors’ records, is located in Appendices C-3 and C-4

7.5 Increasing the Maximum Operating Pressure

Where a low-pressure pipeline was previously designed/approved to an operating pressure less than the maximum permitted in CSA Z662, the operating pressure must not be exceeded unless an engineering analysis has been carried out and written approval has been obtained from the Chief Officer. Determination of an application to increase the operating pressure is based solely on safety considerations and should consider such factors as material properties, the maximum hoop stress rating for the material, the original test pressure, the service history of the pipeline system, and the projected service life of the pipe material.

Polyethylene Pipe Material Codes R, Q and P:

- Non-CSA B137 certified pipe installed prior to 1973 received an "R" designation, which rated the series 125 SDR 11 pipe at 345 kPa (50 psig)
- Interim CSA B137 certified pipe installed between 1973 and 1975 received a "Q" designation which rated the series 125 SDR 11 pipe at 410 kPa (60 psig)
- Operating pressures on material code pipes "R" and "Q" must not exceed these rated pressures.
- CSA B137 certified pipe installed after 1975 received a "P" designation which rated the series 125 SDR 11 pipe at 550 kPa (80 psig)

Any CSA B137 certified pipe can be upgraded to 700 kPa (100 psig) provided an engineering analysis is performed in accordance to CSA Z662.

Maximum Operating Pressures of CIL 219 pipelines:

- Recommendations in a field life study indicated the life expectancy could be extended for pipelines manufactured from CIL 219 resin by lowering the operating pressure from 550 kPa (80 psig) to 410 kPa (60 psig). Rationale was based on the brittle failures experienced in the early life of this pipe.

Procedures for increasing MOP are listed in CSA Z662 Clause 10 and Clause 12.

7.6 Interconnecting Low-Pressure Pipelines with Different Maximum Operating Pressures

Where it is proposed to connect a new low-pressure pipeline to an existing low-pressure pipeline and the new pipeline's design allows for a higher MOP than the pre-existing pipeline, the lower of the two maximum operating pressures must be used for both pipelines unless:

a) The installation of a pressure regulating station between the two pipelines can be justified.
b) The MOP of the pre-existing pipeline can be upgraded in accordance with Section 7.5

8. Pipeline / Plant Surveys and Location Records

8.1 General

Buried distribution pipelines shall be accurately surveyed and plotted on plant location records to satisfy the following considerations:

a. To locate the pipeline for leak detection, future tie-ins, and other general operating purposes.
b. To identify pipeline locations in order that ground disturbance by third parties (or by the distributor) will not cause damage to the pipeline.
c. To accurately register the pipeline easement / right-of-way against the appropriate land title.

For the safety of people and property, all natural gas distributors should register their pipelines with Alberta One Call

"**pipeline**" includes any equipment, apparatus, mechanism, machinery or instrument incidental to the operation of a pipeline;
"**plant**" means a pipeline that
i. is part of a rural gas utility, and
ii. is dedicated to supplying gas to that portion of a franchise area that is annexed by an urban municipality

Accurate records help mitigate the potential for loss of life, personal injury, and/or damage to the environment or property. It is necessary to utilize a considerable degree of care in designing a pipeline route, ensuring that the design route is adhered to through a pre-construction survey, accurately measuring and calculating the actual location of the buried pipeline using recognized survey techniques, and preparing plant location records to serve as a permanent record of pipeline locations.

8.2 Pre-Construction Surveys (Route Planning)

The person undertaking construction of the pipelines and plant should be provided with a planned route to follow so deviations from design plans are minimized. A pre-construction survey should be carried out to ensure that:

a) The pipeline and plant will be located in accordance with design plans that use the most practical and efficient routing available.
b) All other buried pipelines and cables to be crossed are accurately located.
c) Tie-in points to the existing mains are in accordance with construction design(s)
d) Any specific requirements in a utility right-of-way agreement, such as routing of pipelines, are in accordance with landowner's consultations.

8.3 As-Built Surveys

Following construction, the actual location of distribution pipelines and plant shall be accurately surveyed as soon as possible using reliable equipment and proven methods. The respective standards for as-built surveying of each type of pipeline are as follows:

8.3.1 Low Pressure Pipelines

a) Noting that GPS is the industry best practice, the survey equipment to be used must be capable of achieving precision to ± 3 meters.
b) Where a definite construction ditch line is not visible at the time of survey, the pipeline must be located with a dependable pipe-locating device.

8.3.2 High Pressure Pipelines

The Alberta Energy Regulator (AER) is responsible for the standard requirements for the survey of high-pressure pipelines.

8.4 Location Records

Every distributor must maintain an accurate and complete set of location records for their complete distribution system (low and high pressure) and all associated facilities either buried or installed above ground. The Chief Officer, as designated by the *Gas Distribution Act*, may, with cause, request a natural gas distributor to provide a copy of their complete set of records.

Rural Utilities focuses on legislative requirements under the *Gas Distribution Act* and the records associated with all natural gas pipelines and plant under 700 kPa (100 psi) that are operating or abandoned. A web-based GIS application has been developed to show the location of all low pressure pipelines. This application also identifies natural gas distributors that have rural gas franchise areas, or municipal franchises or are independent (private) utilities in Alberta. This GIS dataset is available through the Government of Alberta open government portal, however, actual pipeline locates must be requested through Alberta One Call or through the distributor.

Rural gas franchise areas issued under the *Gas Distribution Act* are digital plans that are created and maintained by Rural Utilities and cannot be altered by distributors. Distributors must apply to the Chief Officer to request any amendments.

8.4.1 Submission of Location Records to Rural Utilities

As the regulator, the Chief Officer requires distributors to submit their location records annually as one of the conditions to issuing an “Approval to Operate”.

By March 31 of each year, distributors submit their location records that must contain the following:

- A listing of all construction done in the prior calendar year that includes:
  - The total number for each type of service installed (Rural, Urban, Commercial, Federal Lands, Re-routes, Re-installs)
  - All upgrade projects
  - Summary of costs (only for distributors eligible for rural gas grants)
  - Total kilometers of low-pressure pipe installed
  - All pipeline abandonments completed
- Single digital mapping file showing all low-pressure active and abandoned pipelines and consumer symbols and submitted in one of the following formats:
  - CAD format - -Bentley MicroStation or PowerDraft DGN
  - GIS format - ESRI SHP or GDB dataset.

9. Operations and Maintenance

9.1 General

Sound operation and maintenance practices are essential for the safe and effective delivery of natural gas service to consumers, for the safety of utility employees and the general public, and to maximize the useful operating life of pipelines and plant. Although each rural gas distributors has the option of expanding their operation and maintenance program to include such services as appliance installation and repair, as an absolute minimum, they are responsible for the safety of natural gas transportation and delivery. As such, they must include in their program sufficient practices, procedures and resources to cover:

a) Operation, inspection, maintenance and repair of all distributor-owned pipelines and plant, between the point where it receives natural gas from a supplier (custody transfer point) to a point(s) where it delivers natural gas to its consumer(s).
b) All incidents resulting in damage to or gas leakage from a distributor's pipeline system shall be filed online with the Chief Officer using the Rural Utilities Portal. Application for access to the Rural Utilities Portal can be made by visiting https://partners.agric.gov.ab.ca and using a My Alberta Digital ID to login. A copy of the leak/ damage field report form is available on the Rural Utilities webpage on www.alberta.ca.
c) Notwithstanding its lack of ownership of pipelines and plant installed downstream of the consumers' meters, emergency response service to a level which will ensure as far as is reasonably possible that persons and property are not exposed to danger.

It is the Chief Officer's' responsibility with respect to the public interest to ensure as far, as is reasonably possible that all rural gas utilities and low pressure distribution pipelines are operated and maintained in accordance with these standards.

9.2 Operations and Maintenance Manuals

A rural gas distributor must develop and keep up to date an operations and maintenance manual to direct its employees in the practices and procedures to be used in the areas of operation, inspection, maintenance, repair, emergency response, tools and equipment and records.

Operations and maintenance manuals must be filed with the Chief Officer except in cases where the distributor has adopted, without change, the "Guidelines for Operation and Maintenance Practices in Alberta Natural Gas Utilities" which has been co-sponsored by Rural Utilities and the Federation of Alberta Gas Co-ops Ltd. In the absence of either a distributor-specific Operations and Maintenance manual filed with the Chief Officer or the adoption of the Federation's Operations and Maintenance Manual, distributors at a minimum are expected to follow operation and maintenance procedures as outlined in the most current version of CSA Z662.

Where a distributor deletes or amends any part of their manual, the distributor must advise the Chief Officer in writing of any deletions or amendments that have been made when submitting amendments to their manuals. Although the Chief Officer recognizes the flexibility and alternative approaches which exist in the preparation of operations and maintenance manuals, it may request that a manual be amended where it is apparent that good operation and maintenance practices are not being addressed.

9.2.1 Operation and Maintenance of Independent (Private) Gas Distribution Systems

Owner-operators of independent (private) natural gas distribution systems following the most current version of CSA Z662 as their operation and maintenance procedure, should work with a qualified third party to develop a program that addresses the practices and procedures to be used in the areas of operation, inspection, maintenance, repair, emergency response, tools and equipment, and records required for pipeline and plant operation and maintenance. Evidence that these procedures are being followed and documented accordingly will be required by the Chief Officer as part of compliance requirements under the *Gas Distribution Act*.

9.3 Training

While a complete operations and maintenance manual will guide employees in the practices and procedures to be used, it is the distributor's responsibility to ensure that all employees receive adequate training in any work they will be expected to undertake. Employees must be trained so that they are competent and qualified to carry out any tasks that are assigned to them including, at a minimum, those in the following areas:

a) Properties of natural gas.
b) Emergency response.
c) Integration of Alberta Occupational Health and Safety Codes
d) Use and care of tools and equipment.
e) Operation, inspection, maintenance and repair of pipelines and plant.
f) Fundamentals of natural gas measurement.
g) Interpretation and use of pipeline and plant records.
h) Use of records and reports.
i) Use of codes, standards, acts, and regulations.

9.4 Pipeline Location for Third Parties

A rural gas distributor must be prepared upon request and on reasonable notice, to provide a pipeline location service in cases where any person or company proposes to carry out a ground disturbance that may cause damage to its pipeline. To ensure that pipelines can be located, the distributor must:

a) Prepare and maintain accurate pipeline and plant location records of their distribution systems.
b) File the location records with Rural Utilities and/or with the AER (for high pressure pipelines only) in order that the existence of the distributor's pipelines may be evident from a review of online pipeline information systems (see Section 8.4).
c) On rural lands outside of the municipal boundaries of cities, towns and villages, register utility rights-of-way or other easements in compliance with Section 11 of the *Gas Distribution Act* with the Land Titles Office so the existence of the distributor's pipeline may be evident from a review of land titles.
d) Accurately locate and mark its pipeline(s) and take any additional steps which are necessary to ensure that the ground disturbance does not cause damage to the pipeline(s). This may include supervising the exposure of the distributor's buried pipelines to ensure that the methods used to carry out the excavation will not cause damage to the pipeline.

Location and, if necessary, supervision services are an inherent responsibility of the distributor in cases where a ground disturbance may affect the distributor's pipeline. Simple locates should be provided at no cost to the person requesting the service unless third parties require complex locates or locates completed in a timeframe that differ from the Alberta One-Call guidelines.

10. Appendix A – Degree-day Method for Establishing Peak Hour Design Loads

A "degree-day" (DD) is essentially a unit of measurement which identifies the difference in degrees Celsius (°C) between a selected base temperature of 18°C and the actual mean daily air temperature in a 24-hour cycle. So, if the mean temperature for a 24-hour cycle is one degree below the mean, then:

DD = (base temperature−mean temperature)

= (18°C − 17°C) = 1 degree-day

With a mean temperature of -40°C in mid-winter: DD = (base temperature − mean temperature)

= [18°C − (-40°C)] = 58 degree-days

The total number of degree-days in any specific period (e.g. a month or a year) is simply tabulated by adding the number of degree-days in each 24-hour cycle for that period.

The application of the degree-day concept to peak design loads is limited to existing consumers with a billing history and whose consumption is primarily for space heating. It relates the consumption to the number of degree-days during a specified heating period to establish the peak hourly load for an individual consumer. The total demand on a system is then extrapolated by applying appropriate coincidence factors as described in subsection 4.4

The peak hour design load for an individual consumer is based on the coldest day that would normally be expected during a heating season, usually -40°C. It recognizes that, although this low temperature will likely be accompanied by a wind-chill factor, additional heat should be generated by occupants and appliances to essentially compensate for this secondary factor.

The following hypothetical example illustrates the step-by-step method of calculating the approximate peak hourly design load for an individual consumer using the degree-day method.

Energy Consumption and Degree-day History

Data needed includes the consumer's natural gas energy consumption and the number of degree-days at his location for the same annual billing period.

Period	Consumption (GJ)	Degree Days (DD)
July	7	57
August	4.6	47
September	17.6	368
October	23.2	550
November	40.6	800
December	48	1157
January	38.2	880
February	35.2	870
March	21	596
April	17.6	416
May	9	187
June	6.6	135
Total	**268.6**	**6063**

For this particular consumer, the peak design load may be estimated using the energy consumption of 268.6 GJ and a degree-days total of 6063 DD. Note that the monthly consumption to degree-day ratio will not always be consistent due to the timing of meter reads and other factors. For this reason the estimate should be based on annual data.

Assume:

a) Average heating value of gas: 1000 BTU/ft³ or 1.055 GJ/1000 ft³ or 26.853 m³/GJ
b) Coldest day experienced: -40°C all day
c) Furnace cycling: equal (50%) on-off
d) Impact of other appliances: minimal

Convert natural gas energy consumption to volume:

Assumption: 1000 ft³ = 1.055 GJ

$$(number\ of\ GJ\ consumed) \times \frac{1000}{1.055}\frac{ft^3}{GJ} = cubic\ feet\ of\ gas\ used$$

$$(268.6\ GJ) \times \frac{1000}{1.055}\frac{ft^3}{GJ} = 254{,}600\ ft^3$$

Assumption: 1 GJ = 26.853 m³

$$(number\ of\ GJ\ consumed) \times \frac{26.853}{1}\frac{m^3}{GJ} = cubic\ meters\ of\ gas\ used$$

$$(268.6\ GJ) \times \frac{26.853}{1}\frac{m^3}{GJ} = 7{,}212 m^3$$

Calculate the average volume per degree-day (for this hypothetical case):

$$\frac{Total\ volume\ of\ gas\ used\ over\ period}{Number\ of\ degree - days\ in\ same\ period} = \frac{ft^3}{DD}$$

$$\frac{254{,}600}{6063}\frac{ft^3}{DD} = 42\ \frac{ft^3}{DD}$$

$$\frac{Total\ volume\ of\ gas\ used\ over\ period}{Number\ of\ degree - days\ in\ same\ period} = \frac{m^3}{DD}$$

$$\frac{7{,}212}{6063}\frac{ft^3}{DD} = 1.19\ \frac{m^3}{DD}$$

Calculate the degree-day equivalent for one hour on -40°C day:

$$\frac{18 - (mean\ temperature)}{number\ of\ hours\ in\ a\ day} = \frac{degree - day}{hour}\ \frac{DD}{hr.}$$

$$\frac{18 - (-40)}{24}\ \frac{DD}{hr.} = 2.42\ \frac{DD}{hr.}$$

Calculate the average volume for an equivalent degree-day/hour:

$$(Average\ volume\ per\ degree - day) \\ \times (Degree - day\ per\ hour\ equivalent) \\ = average\ consumption\ per\ hour\ on\ a\ -40°C\ day$$

Imperial units:

$$42 \frac{ft^3}{DD} \times 2.42\ \frac{DD}{hr.} = 101.50\ \frac{ft^3}{hr.}$$

Metric units:

$$1.19\ \frac{m^3}{DD} \times 2.42\ \frac{DD}{hr.} = 2.875\ \frac{m^3}{hr.}$$

Calculate average peak hour design load, recognizing the cyclic operation of the furnace:

Assumption: furnace cycle 50% on & 50% off

$$Peak\ design\ load = \frac{Average\ consumption\ per\ hour\ on\ -40°C\ day}{Proportion\ of\ time\ that\ furnace\ is\ on}$$

Imperial units:

$$Peak\ design\ load = \frac{101.5\, ft^3/hr.}{0.50} = 203.00\, ft^3/hr.$$

Metric units:

$$Peak\ design\ load = \frac{2.875\, m^3/hr.}{0.50} = 5.75\, m^3/hr.$$

Therefore, the estimated peak design load for this consumer would be rounded to 203 ft^3/hr or 5.75 m^3/h.

It must be noted that the number of degree-days for any specific time period (day, month or year) will differ between periods and between locations throughout the province. For the meteorological stations maintained in Alberta by Environment Canada, the annual degree-days may range from a typical 5000 in southern Alberta to 7500 in the extreme north of the province. What this 50 per cent increase in annual degree-days means is that a consumer in the north with an identical home, appliances and furnace/thermostat utilization as the consumer in the south would consume about 50 per cent more energy during that year. However, with the same characteristics, both consumers would still have similar peak hour design loads.

Actual degree-day data is available from Environment Canada for specific locations and for selected billing periods. This data may then be used to complete the above calculations for any specific consumer and avoid the need to conduct an updated load survey for that consumer.

11. Appendix B – Control Areas for Low Pressure Pipelines Paralleling Local Municipal Roads Administered by Counties and Municipal Districts

For the purpose of proposed low pressure gas pipeline installations (i.e. pressure of 700 kPa or less) parallel to local municipal roads, a designated control area as described below should be utilized by distributors and municipal authorities on a consultative and cooperative basis to facilitate road planning operations such that unnecessary relocation or lowering of pipelines due to road alterations, widening or relocation is avoided. However, the defined width of the control area should not be interpreted as a mandatory setback distance from the municipal roadway. Instead, it represents the area within which the municipal authority should be consulted so that it may define its requirements and protect its interest with regard to roadway development or potential future expansion of existing roadway development.

The control area for each type or category of municipal roadway is defined as a distance from the center line of the roadway which, unless otherwise identified, is represented by the center of the original road allowance. For any control area in question, the municipal authority should, upon request, provide information for those roadways where the center line is to be otherwise defined.

The designated control areas are:

a) 30 meters from the centerline of internal subdivision roads and service roads.
b) 40 meters from the centerline of the roadway for local municipal roads on the statutory road grid including forced roads, road diversions and service roads along highways which supplement the statutory road grid.
c) 50 meters from the centerline of the roadway for municipal roads designated by the department as park roads.
d) 100 meters from the centerline of any municipal roadway in areas of extreme adverse terrain conditions such as ravines and steep side hills.

For each proposed pipeline installation that will be located within a control area, the distributor is responsible for submitting details of the proposal to the municipal authority. The submission should, as a minimum, identify the proposed pipeline route relative to all legal property boundaries within the control area.

Based on the distributor's submission, the municipal authority may choose to endorse the proposal or advise the distributor that the proposed pipeline route should be amended to conflict with future road planning. The distributor should work collaboratively with the municipal authority to understand any conflicts identified in the proposal. Generally, these may include any of the following:

- The possibility of widening of the road allowance to the width normally acquired by the municipal authority for the standard of the road in question.
- The need for an access control reserve buffer adjacent to the widened road allowance boundary in areas of existing or anticipated subdivisions.
- Any additional clearance beyond the typical boundaries of the road allowance to allow for uneven terrain conditions. The additional clearance required should be estimated by the municipal authority, and if the distributor feels that this estimate is excessive for the terrain condition in question, it may request that the requirement be reconsidered by the municipal authority on the basis of surveyed topographical information. The distributor would be required to submit such information to the municipal authority in support of this request.

The distributor should seek a recommendation from the municipal authority of an alternative route which will not conflict with future road planning. If possible, the distributor should attempt to utilize this amended route. However, where it is impractical to do so (e.g., landowner consent cannot be obtained), the distributor and the municipal authority may co-operate in establishing an alternate route which may be reasonably satisfactory to both parties, but may still contain a conflict with a future roadway plan. In such cases, the distributor should be prepared to bear the cost of pipeline relocation where the conflict identified by the municipal authority does in fact occur in future road improvements.

12. Appendix C – Reference Information

C-1 Pipeline Test Confirmation

PIPELINE TEST CONFIRMATION

Year Completed ____

Distributor: ______________________

Customer	LSD (End Location)	Tap	Load	Pipe					Test Pressure	
				Length	Ext	Resin	SDR	Reel	KPa	Duration

I hereby certify that the test information specified above is accurate and that test procedures used comply with the Gas Distribution Act.	Name(Print)	
Signature Date	Representing	Fax Telephone

Test Chart Information Table 1

Pipeline Project Name	From Location	To Location
Pipe Size	SDR #	Resin
Extruder	Yr. Extruded	
Pipe Reel #'s	**Pressure @Start of Test (Psig/KPa)**	**Pressure@ End of Test (Psig/KPa)**
Test Verified By		

The same information is shown below in a format which can be used to create a stamp or label placed on a test chart or work order

Test Chart Information Table 2

TEST CHART INFORMATION

P/L TO Location ________________________________

Pipe Reel #s ___________________________________

Pipe Size(s) ________________ Resin: ____________

Extruder: __________________ Yr. Extruded _________

SDR # _______ Pres. @ End of Test __________ psig/kPa

Test Verified By: _______________________________

C-2 Asset Management (Pipe) Codes

1. Facility Codes

Facility	Codes
Meter/Reg Station	MS
Regulator Station	RS
Pipeline	PL
Customer	CO
Blind End or Capped	BE

2. Material Codes

Material	Code
Polyethylene	P
Steel	S
Aluminum	A
PVC	V
Composite	G

3. Polyethylene Resin Type Codes

Resin	Codes
PolygasK38-20 Solvay/Ineos(2406/2708)	AT
Novacor 2100U(A) (2406/2708)	AU
Dow Continuum 2490	AW
Dow Continuum 2492/2494	BB
Ineos TUB 122	BC
Dow Continuum 2420	BD

4. Polyethylene Extruder Codes

Extruder	Code
Polytubes	M
KWH	T
Shawcor(URS Flint Global)	V

5. Joint Codes

Joint	Code
Electrofusion	E
Butt Fusion	B
Socket Fusion	S
Mechanical Coupling	M
Welded	W
High Energy Joint	H

6. HP Pipe Specification

Pipe Specification	Type	Grade
API 5L, Grade A	5L	A
ASTM A53, Grade A	A53	A
CSA Z245.3, Grade 42 Cat 1	Z245.3	42.1
Coiled Aluminum	6063	T1A
Coiled Aluminum	6063	T1B
Composite Pipe RTP	FPLP	301/601

7. Status Codes

Status	Codes
Operating	O
Abandoned	A
Removed	R
Delete Data	D

8. Pipe Dimensions SDR

Nominal Size (mm)	Wall Thickness (mm)
15.9	2.28
26.7	2.41
33.4	3.02
42.2	4.22
48.3	4.39
60.3	5.49
73	6.63
88.9	8.08
114.3	10.39
168.3	15.29
219.1	16.23 # (SDR 13.5)
323.4	25.44 #(SDR 13.5)
323.4	20.12 ##(SDR 17)

C-3 Historical Polyethylene Gas Pipe Extruders & Resin Codes

HISTORICAL PIPE CODES

RESIN	CODE
CIL 219	AA
Sclair 34D	AB
Dow N 3306	AC
EP 237	AD
Phillips TR 418 (Black)	AE
Phillips TR 418 (Orange)	AF
Phillips Marlex 7000	AG
Gulf 9300T (Orange)	AH
Gulf 9300T (Yellow)	AK
Dupont Sclair 35B	AM
Phillips Marlex 8000	AN
Chevron 9300T	AP
Dupont Sclair 34F	AR
Phillips TR418-6500(Yellow)	AS
Solvay Polygas K38-20	AT
Novacor (Hey 2406) 2100 A & U	AU
Chevron 9302T	AV
Gulf 9300 Orange (2406)	AK
Marlex 8000 (3406)	AN
Chevron 9300T (2406)	AP
Drisco 6500 (TR 418) Yellow (2406)	AS

EXTRUDER	CODE
AMP Inc.	A
Beta Plastics	B
Building Products of Canada Ltd.	C
Continental Industries Ltd.	D
Dome-X Plastics Ltd. (Mapleleaf)	E
Dupont Canada Ltd.	F
Kubota Iron & Machinery Works Ltd.	G
Megadyne Industries Ltd.	H
Nipak Inc.	I
Parker-Hannifin (Canada) Ltd.	J
Phillips Products Co. Ltd.	K
Plastics Extruders Ltd.	L
Polytubes Ltd.	M
Rahn Metals & Plastics Ltd.	N
Scepter	O
Shaw Flexible Tubes Ltd.	P
Shawinigan Chemicals Ltd.	Q
Standard Pipe Protection Division- General Steel Industries Inc.	R
Tex-Tube Div. - Detroit Steel Corp.	S
Wilk & Hoeglund (KWH)	T
Foothills Plastics (1991) Inc.	U
Phillips	K

C-4 Historical Pipe Codes – ERCB (Energy Resources Conservation Board)

Prior to transfer of low-pressure natural gas distribution licensing to Rural Utilities

Table 1

TYPE OF LINE CODES

Type of Line	Code
Distribution Line	D
Flowline	F
Fluids Line	L
Gas Line	G
*Installation	N
Multiphase Line	M
Oil Line	O
Secondary Line	S
Solids Line	H

*For applications where "installations" only are involved

Table 2

PIPELINE SUBSTANCE CODES

Group 1

Substance	Code
Crude Oil	CO
Fresh Water	WA
Fuel Gas	FG
Fuel Gas Propane	FP
Glycol	GL
Multiphase Fluids	
Category 1	M1
Category 2	M2
Natural Gas	NG
Salt Water	SW
Sour Crude Oil	SO
Sour Fuel Gas	SF
Sour Natural Gas	SG
Steam	ST
Synthetic Crude Oil	SC

Group 2

Substance	Code
Methane	21
Ethane	22
Propane	23
Butane	24
Pentanes	25
Pentanes Plus	26
Condensate	27
Gasolines	28
Diesel Fuel	29
Kerosene	30
Solvents	31
Heating Oil	32
Liquefied Natural Gas	33

Group 3 – Minerals (Liquid)

Substance	Code
Sulphur	41
Ammonia	42
Helium	43
Methanol	44

Group 4 – Minerals (Gaseous)

Substance	Code
Carbon Dioxide	61
Ammonia	62
Helium	63
Synthetic Natural Gas	64
Hydrogen Suphide	65
Hydrogen	66

Group 5 – Minerals (Solids)

Substance	Code
Coal	81
Sulphur	82
Fertilizer	83

Table 3

FACILITY CODES

Facility	Code
Battery	B
Blind End	BE
Compressor Station	CS
Consumer	CO
Creek	CK
Experimental Station	ES
Gas Processing Plant	GP
*Gas Protection Line	GL
Injection Plant	IP
Lake	LA
Meter / Regulator Station	MR
Meter Station	MS
Petrochemical Plant	PP
Pipeline	PL
Pipeline Terminal	PT
Pump Station	PS
Refinery	RF
Regulator Station	RS
Reservoir	RE
River	RI
Satellite	S
Storage Cavern	SC
Storage Tank	ST
Tank Farm	TF
Unloading Rack	LR
Well	WE

*Under the jurisdiction of the Gas Protection Branch, Alberta Department of Labour

NOTE: Minor facilities such as separators, dehydrators, line heaters, etc., are not coded and should be ignored for the purposes of the form.

Table 4

PIPE MATERIALS CODES

Pipe Material	Code
Aluminum	A
Asbestos Cement	H
Fibreglass	F
Polyethylene (CSA Certified)	P
Polyethylene (Interim Certified)	Q
Polyethylene (Not Certified)	R
Polyvinyl Chloride	V
Steel	S

Table 5a

CODES FOR TYPE AND GRADE OF STEEL PIPE

Pipe Specifications	Type	Grade
API 5L GRADE A	5L	A
API 5L GRADE B	5L	B
API 5LX GRADE X42	5LX	X42
API 5LX GRADE X60	5LX	X60
ASTM A53 GRADE B	A53	B
ASTM A106 GRADE C	A106	C
ASTM A333 GRADE 7	A333	7
CSA Z245.2 GRADE 52 CATEGORY 1	Z245.2	52 1
CSA Z245.3 GRADE 42 CATEGORY 2	Z245.3	42 2
CSA Z245.4 GRADE 35 CATEGORY 1	Z245.4	35 1
CSA Z245.5 GRADE 52 CATEGORY 3	Z245.5	52 3

Table 5b

CODES FOR TYPE AMD GRADE OF ALUMINUM PIPE

Pipe Specifications		Codes	
Alloy Number	**Aluminum Association Alloy No.**	**Type**	**Grade**
15-H11A	1050-H11A	1050	H11A
35-H11A	3003-H11A	3003	H11A
B575-H11A	5005-H11A	5005	H11A
65S-T4	6061-T4	6061	T4
50S-T6C	6063-T6C	6063	T6C
B151-T4A	6351-T4A	6351	T4A
----	6063-T1A (coiled aluminum)	6063	T1A

Table 5c

RESIN CODES

Resin Code	Code
CIL 219	AA
SCLAIR 34D	AB
DOW N 5303	AC
EP 237	AD
TR 418 BLACK	AE
TR 418 ORANGE	AF
MARLEX 7000	AG
GULF 9300 T	AH
ALATHON 6044-OC-001	AJ
GULF 9302T	AK

Table 5d

EXTRUDER CODES

Extruder	Code
Amp Inc.	A
Beta Plastics	B
Building Products of Canada Ltd.	C
Continental Industries Inc.	D
Dom-X Plastics Ltd.	E
Dupont of Canada Ltd.	F
Kubota Iron & Machinery Works Ltd.	G
Magadyne Industries Ltd.	H
Nipak Inc.	I
Parker-Hannifin (Canada) Ltd.	J
Phillips Products Co. Ltd.	K
Plastex Extruders Ltd.	L
Polytubes Ltd.	M
Rahn Metals & Plastics Limited	N
Scepter	O
Shaw Flexible Tubes Ltd.	P
Shawnigan Chemicals Limited	Q
Standard Pipe Protection Division, General Steel Industries Inc.	R
Tex-Tube Division, Detroit Steel Corporation	S

Table 5e

CODES FOR TYPE AND GRADE OF FIBREGLASS PIPE

Pipe Specification	Type	Grade
CIBA 512	CIBA	512
CIBA 300	CIBA	300
RED THREAD 300	REDTHR	300
BLUE STREAK 300	BLUEST	300

Table 5f

CODES FOR TYPE AND GRADE OF POLY VINYL CHLORIDE PIPE

Pipe Specifications	Type	Grade
PVC 1120, SEROES 160, EXTRUDED BY BUILDING PRODUCTS	1120	C160
PVC 2110, SDR 32.5, EXTRUDED BY SCEPTER	2110	325
PVC 1220, SCHEDULE 80, EXTRUDED BY KUBOTA	1220	G

Table 5k

CODES FOR TYPE AND GRADE OF ASBESTOS-CEMENT PIPE

Pipe Specifications	Type	Grade
TURNALL PRESSURE PIPE, CLASS 150	TURNAL	150

Table 6

JOINT CODES

Joint	Code
Bell & Spigot Welded	A
Bonded	C
Butt Fusion	B
Flanged	F
High Energy Welding	H
Mechanical Coupling	M
Pronto Lock	P
Socket Fusion	S
Solvent Welding	G
Threaded	T
Welded	W
Zap-Lok	Z

Table 7

STATUS CODES

Status	Code
Abandoned	A
Discontinued	D
Operating, or to be operated	O
Removed	R
Suspended	S
To be constructed	Blank

Table 8

ENVIRONMENT CODES

Crossing Type	Code
Creek Crossing	CC
Lake Crossing	LC
Overhead Crossing (Creeks and Rivers only)	OC
River Crossing	RC

Table 9

TYPE OF INSTALLATION CODES

Installation	Code
Compressor Station	CS
Meter / Regulator Station	MR
Meter Station	MS
Pump Station	PS
Regulator Station	RS

Table 10

PRIME MOVER CODES

Type of Prime Mover	Code
Electric	E
Reciprocating	R
Turbine	T
Multiple (where more than one type is used)	M

Table 11

VENTING CODES

Method of Venting	Code
Atmosphere	A
Flare	F

Table 12

DISPOSAL CODES

Method of Disposal	Code
Barrels	B
Surface Pit	S
Tank	T
Underground Sump	U