

TECHNICAL STANDARDS
AND
SPECIFICATION MANUAL
FOR
GAS DISTRIBUTION SYSTEMS

Safety, Design,
Construction, Operation and
Maintenance of Natural Gas
Distribution Systems in
Alberta

Sixth Edition
NOVEMBER 2010

Foreword

This Sixth Edition of the Technical Standards and Specifications Manual has been updated to reflect changes to technical standards which have occurred since 2005. This manual is issued in accordance with provisions of Section 2(1) of the Gas Distribution Act and should therefore be considered as having the same authority as the Act.

Any inquiries concerning this manual should be referred to:

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1. Scope and Application

The scope of this manual is illustrated with Figure 1.1 and includes:

- (a) Any part of a gas distribution system within a franchise area that has been approved and issued under the authority of the Gas Distribution Act.
- (b) Any gas distribution pipeline operating at 700 kPa or less which is located within Alberta

This manual covers the key aspects of safety, design, construction and operation, which the Chief Officer (as defined in the Gas Distribution Act) (the Division) considers necessary for the orderly and effective development of gas distribution systems.

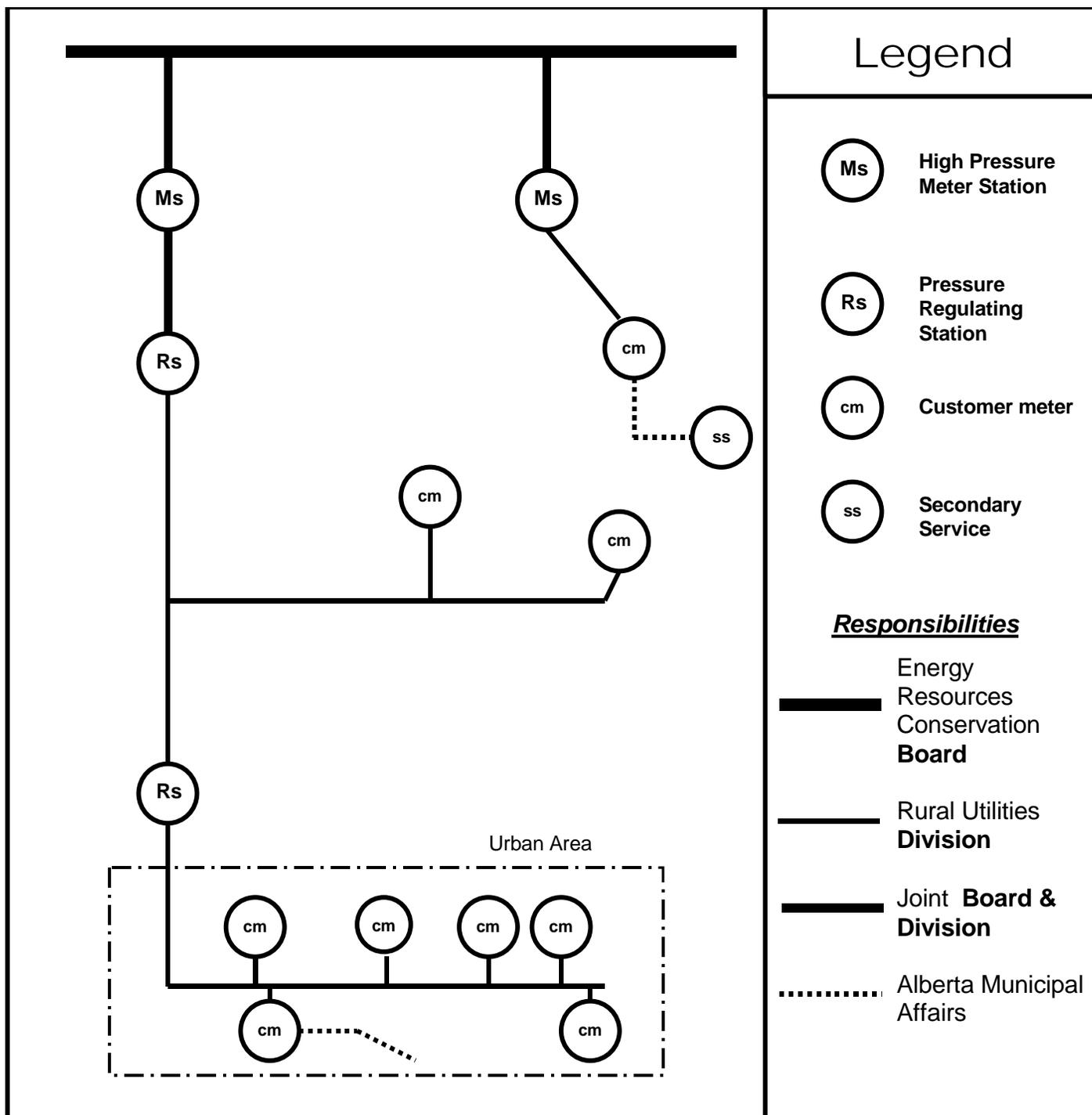


FIGURE 1.1 SCOPE OF MANUAL

NOTES:

1. High pressure pipelines that are downstream of transmission pipelines have a joint Board/Division responsibility as per the Gas Distribution Act.
2. Secondary gas line downstream of the service regulator (Customer meters) are the under the regulatory authority of Municipal Affairs.

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, the Canadian Standards Association (CSA) and other organizations should be consulted.

The latest edition of the CSA standard published as CAN/CSA Z662 “Oil & Gas Pipeline Systems” should be considered as the principal guideline for the design, construction and operation of distribution systems. Regulations covering gas pipeline systems in Alberta require compliance with the CAN/CSA Z662 standard, although these regulations include some variations to provisions in the standard.

Since the scope of this manual covers some distribution pipelines, which fall within the jurisdictions of the Rural Utilities Division (the Division), the Energy Resources Conservation Board (the Board) and the Safety Services Branch of the Public Safety Division of Alberta Municipal Affairs (Municipal Affairs), the following principles should apply where dual jurisdiction exists:

- (a) Where a minimum specification issued by the Board exceeds a specification contained in this manual, the Board’s specification shall prevail.
- (b) Where a minimum specification contained in this manual exceeds a specification issued by the Board, the specification in this manual shall prevail.
- (c) Where a minimum specification issued by Municipal Affairs exceeds a similar specification contained in this manual, the Municipal Affairs’ specification shall prevail.
- (d) Similarly, where a minimum specification issued by any other Provincial or National Act /Regulation exceeds a similar specification contained in this manual, that Act or Regulation’s specification shall prevail.

3. Definitions

“**The Division**” means the Rural Utilities Division of the Department of Agriculture and Rural Development.

“**Distribution System**” means an integrated network of distribution pipelines and associated appurtenances.

“**Distribution Pipeline**” means a pipeline used to transport and deliver gas to consumers.

“**Distributor**” means the person or corporation that owns a distribution pipeline or distribution system.

“**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, peak removing, quarrying, clearing and grading, but does not include:

- (i) Except as otherwise provided in sub-clause (ii) below, a disturbance of the earth to a depth of less than 300 mm that does not reduce the earth cover over the pipeline to less than the depth of cover provided when the pipeline was installed.
- (ii) Cultivation to a depth of less than 450 mm below the surface of the ground.

“**High pressure pipeline**” means a distribution pipeline, which is designed to be licensed and/or to be operated at a pressure in excess of 700 kPa.

“**Low pressure pipeline**” means a distribution pipeline which is designed or is intended to be operated at a pressure 700 kPa or less.

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

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

“**PE100**” means high density bi-modal polyethylene pipe. Also referred to as 4710 or HDPE.

“**RTP**” means reinforced thermoplastic pipe. Also referred to as FPLP.

4. Design

4.1 General

In designing a new distribution system, or an addition or improvement to an existing system, a certain amount of judgment and flexibility is required. For example, some judgment is usually required in deriving the peak hour design load to serve consumers' needs. This is particularly so when the utilization of the appliances which will consume the gas cannot be forecast with a sufficient degree of accuracy. An example of the need for flexibility is a loop line, which is required to decrease the pressure drop across the system. Often, a number of optional locations exist for this loop while the loop itself can be altered in relation to its length and diameter.

In such cases, the Division will acknowledge and generally accept the fact that the designer may select a design option of his or her own choosing. However, the Division requests the use of an alternative design where in its opinion the alternative will be more effective and cost efficient.

High performance "bi-modal" high-density polyethylene (PE100) is now in use in gas distribution systems and is part of the Division's Quality Assurance Program. Designers should be using the dry gas distribution Design Coefficient (C_a) = 1.6 in the MRS design formulas to ensure a 50-100 year life of the gas distribution system.

4.2 Establishing Peak Hour Design Loads

In the design of a distribution system, pipe sizing is influenced primarily by the maximum hourly volume of gas, which the system is required to transport. Accordingly, if the designer is to ensure that the system design will meet (but not greatly exceed) the requirements of the consumers served by the system, peak hour design loads must be derived with a certain amount of care.

The volume of gas, which the system must transport, is determined from a combination of the following criteria:

4.2.1. *Maximum Connected Load*

The maximum connected load of the individual consumer can be calculated by establishing and tabulating the burner input rating of all appliances. This assumes the possibility that, for example, that a consumer may operate a furnace, water heater, clothes dryer, oven and all stove top burners at the same time. While this may not happen too often, this total potential load should be used to size the service line and, of course, the gas meters.

Establishing the maximum connected load for purposes of sizing the service line and meter is not quite so simple in cases where, for example, special agricultural equipment such as irrigation engines and grain dryers are served from the same service line and meter. Due to the seasonal utilization of this equipment, it is unrealistic to simply total the maximum burner rating of appliances and equipment. In such cases, the designer must apply some judgment.

4.2.2 Peak Design 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 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 perhaps as little as only 50% 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 0.5 would ensure that the main would be sized to carry sufficient but not excessive capacity to meet the needs of consumers at peak flow conditions.

4.2.3 *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, industrial loads that are not sensitive to ambient temperature changes, and other factors. Since the only detailed studies, which have been conducted on the subject of coincidence factors, have focused on systems servicing large cities, there are no substantive industry guidelines available to assist the designer in deriving coincidence factors for a rural gas distribution system. A designer should, therefore, establish his own guidelines based on a comparison between the theoretical pressure drop from calculation and the actual pressure drop being experienced at the lowest ambient temperature experienced.

4.2.4 *Consumer Load Surveys*

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

Care must be taken in establishing future load requirements and the requirements for large load equipment (including the new On Demand Instantaneous Hot Water Systems) since this information has a significant impact on system sizing and costs. While allowance should be made for future additional loads, if appropriate, 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.

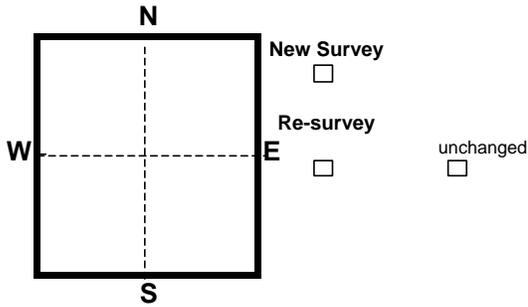
**FIGURE 4.1
LOAD SURVEY FORM - RURAL GAS PROGRAM**

GAS CO-OP LIMITED

Date: _____

LSD

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



The Diagram shown represents the section on which the farmstead is located. Please indicate the position of the farmstead and complete the blanks below.

Owner's Name _____
 Account # _____ Riser # _____
 1/4 Section _____ Section _____
 Township _____ Range _____ W__M
 Lot ___ Block ___ Plan # _____
 Surveyed by _____

PRESENT BTU/HR REQUIREMENTS

Main House Secondary House # of Storeys _____

<u>Appliance</u>	<u>Basement</u>	<u>Main Floor</u>	<u>BTU/hr</u>
Furnace _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
Furnace _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
Fireplace _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
Water Heater _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
Water Heater _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
On Demand Hot Water System _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
Clothes Dryer _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
Stove _____	<input type="checkbox"/>	<input type="checkbox"/>	_____
_____	<input type="checkbox"/>	<input type="checkbox"/>	_____

Outside Buildings

<u>Type of Building</u>	<u>Appliance</u>	<u>BTU/hr</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Irrigation

LARGE LOAD EQUIPMENT

Gas Engine BHP _____ x 12000 BTU/hr
 Max. Seasonal Use _____ to _____ # of Hours Per Day _____ Avg
 Grain Dryer _____
 Max. Seasonal Use _____ to _____
 Other (Specify) _____

Remarks:- Existing meter type and size (if applicable)

Total BTU/hr-

4.2.5 *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 reasonably estimated by considering the consumers' actual consumption for a specific billing period and the number of degree-days locally for that same period. A discussion on 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, essentially limited to existing consumers who have generated a billing history and whose peak design load is primarily influenced by ambient temperatures, i.e. space heating purposes.

4.3 Sizing of Distribution Systems

As noted in Section 4.2, the principal factor influencing the sizing (i.e. pipe diameter) of a distribution system is the peak design load which the system is required to transport. The next most significant factor is the mathematical model used to calculate dynamic pressure loss over a segment of pipeline and hence determine its size. 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, are generally acceptable to the Division.

4.4 General Design of Distribution Systems

A designer will usually have many options available for routing and sizing a new distribution system or an addition to a system to improve capacity. 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 are the principal factors, which the designer must consider.

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

- (a) 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 minimum cost.
- (b) As an alternative to looping, consideration should be given to interconnecting systems.

4.5 Routing of Distribution Systems

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

- (a) The requirements of any government body, or any regulatory authority, 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 a distributor's pipelines. In addition, the designer should take account of the effect of adjacent overhead power lines on a steel or aluminum pipeline that is to be located adjacent to that power line.
- (d) Any proposal to amend the use of the land in which it is proposed to locate pipelines.
- (e) The sub-surface condition of the land in which it is proposed to locate pipelines. 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 it is proposed to install distribution pipelines. 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.
- (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 pipelines.
- (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. Where it is feasible and within economic reason to do so, pipelines should be located by a "grid system".
- (j) The capital cost associated with alternative routes.

4.6 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 for 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 4.7.

The minimum clearance to be maintained between a pipeline and any other facility or structure that it parallels or crosses should be in accordance with the latest edition of the CAN/CSA-Z662.

4.7 Crossings of Other Facilities

The design of any distribution pipeline crossing of 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 Division are illustrated in Figures 4.2 to 4.7 inclusive.

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 disturbances above or adjacent to the pipeline.

The depths of cover specified in Figures 4.2 to 4.7 inclusive 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 very often 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 being 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 and hence ensure that the crossing is located and designed so that it will remain undisturbed for its operational lifespan, even if future development takes place at the crossing site. This consultative process applies to the following aspects of highway or road crossings as outlined in Figures 4.2 and 4.3:

- (a) The depth of cover under the lowest point in the right-of-way (usually the ditch bottom) which is, as a minimum, either 1100 mm or 1400 mm depending on the type of road being crossed (see Figure 4.3).

- (b) These depths of cover should be adequate for most crossings, but should be increased if, following consultation with the road authority, it is determined that future roadway development plans will necessitate pipe replacement or lowering.
- (c) The standard distance of any vertical bends from the edge of the right-of-way as specified in Figure 4.2 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 pipeline should this be required by future roadway improvements.
- (d) Crossings of undeveloped road allowances at the nominal installation depth of 800-mm 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, the crossing should be designed and installed to suit the profile of the proposed road.

See Section 5.9 for information relating to warning signs.

FIGURE 4.2

Standard Dimensional Information for Highway or Road Crossings

ROAD TYPE	ROAD AUTHORITY	MINIMUM DEPTH OF COVER	STANDARD LOCATION OF HORIZONTAL OR VERTICAL BENDS
Multi-lane provincial highways	Alberta Transportation	1400 mm	30 m from edge of right-of-way
Major 2 lane provincial highways	Alberta Transportation	1400 mm	30 m from edge of right-of-way
Minor 2 lane provincial highways	Alberta Transportation	1400 mm	30 m 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 Section 4.8.

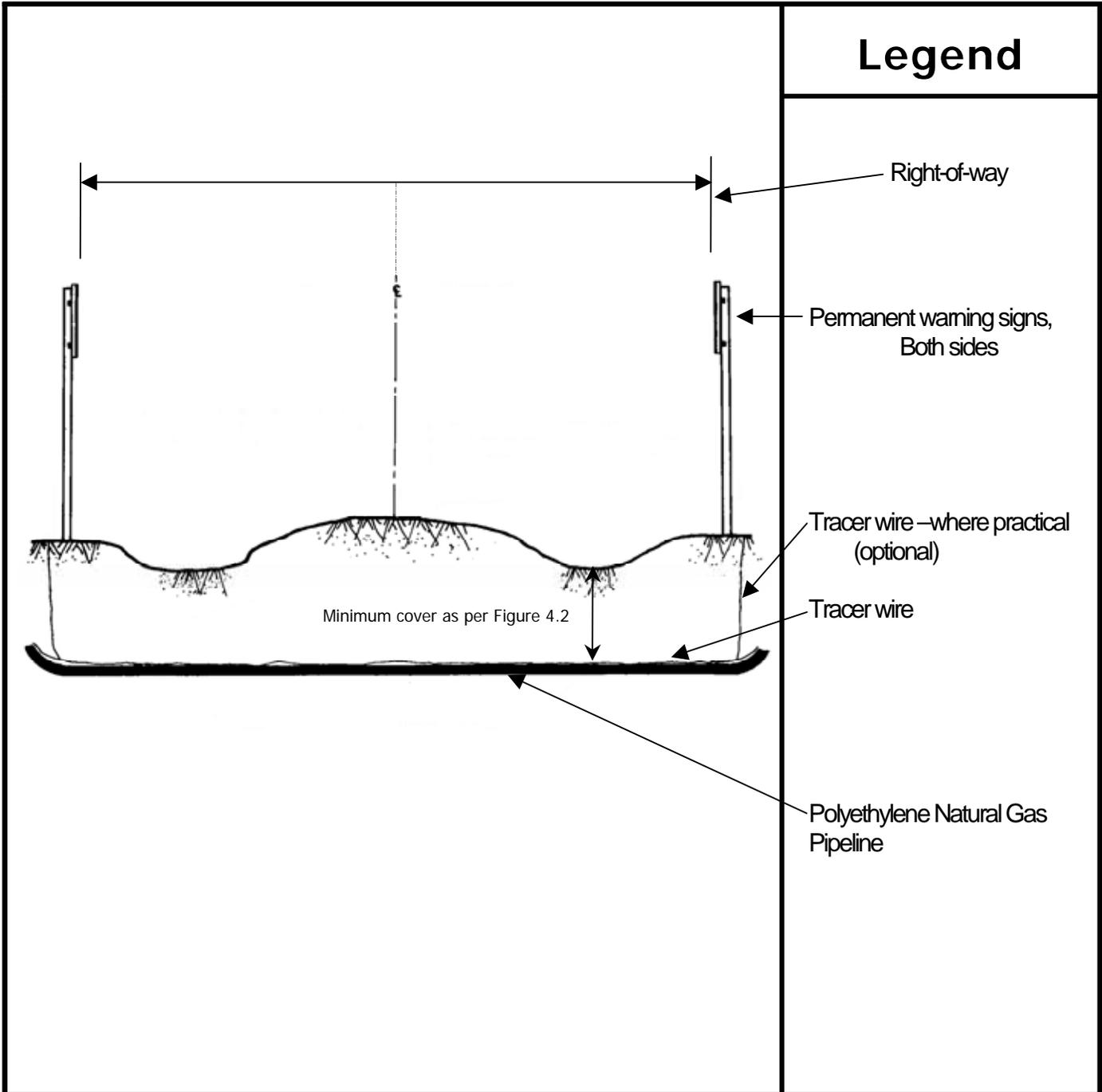
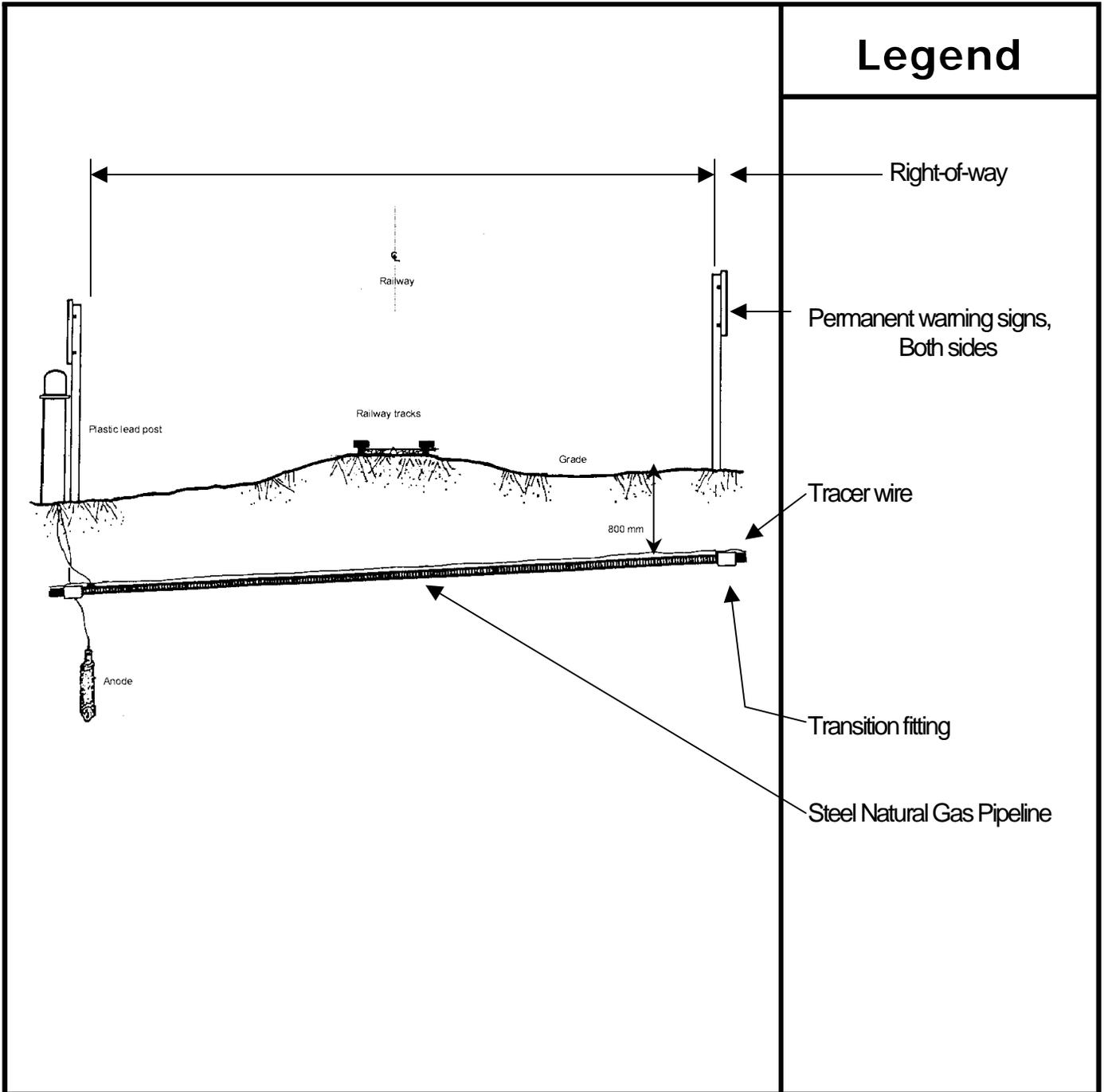


FIGURE 4.3 : TYPICAL HIGHWAY OR ROAD CROSSING

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.



Legend

Right-of-way

Permanent warning signs,
Both sides

Tracer wire

Transition fitting

Steel Natural Gas Pipeline

FIGURE 4.4 : TYPICAL RAILWAY CROSSING

NOTES:

1. National railway crossings to be built and maintained in accordance with Transport Canada's "Standards Respecting Pipeline Crossings Under Railways -TC E-10" (as revised at time of construction).
2. Other railway crossings to be built in accordance with CAN/CSA Z662 (as revised at time of construction).
3. Crossing materials may be either uncased steel carrier pipe c/w suitable coating and cathodic protection or cased DR 11 or DR 13 PE with steel casing. Material to be specified in consultation with railway owner.

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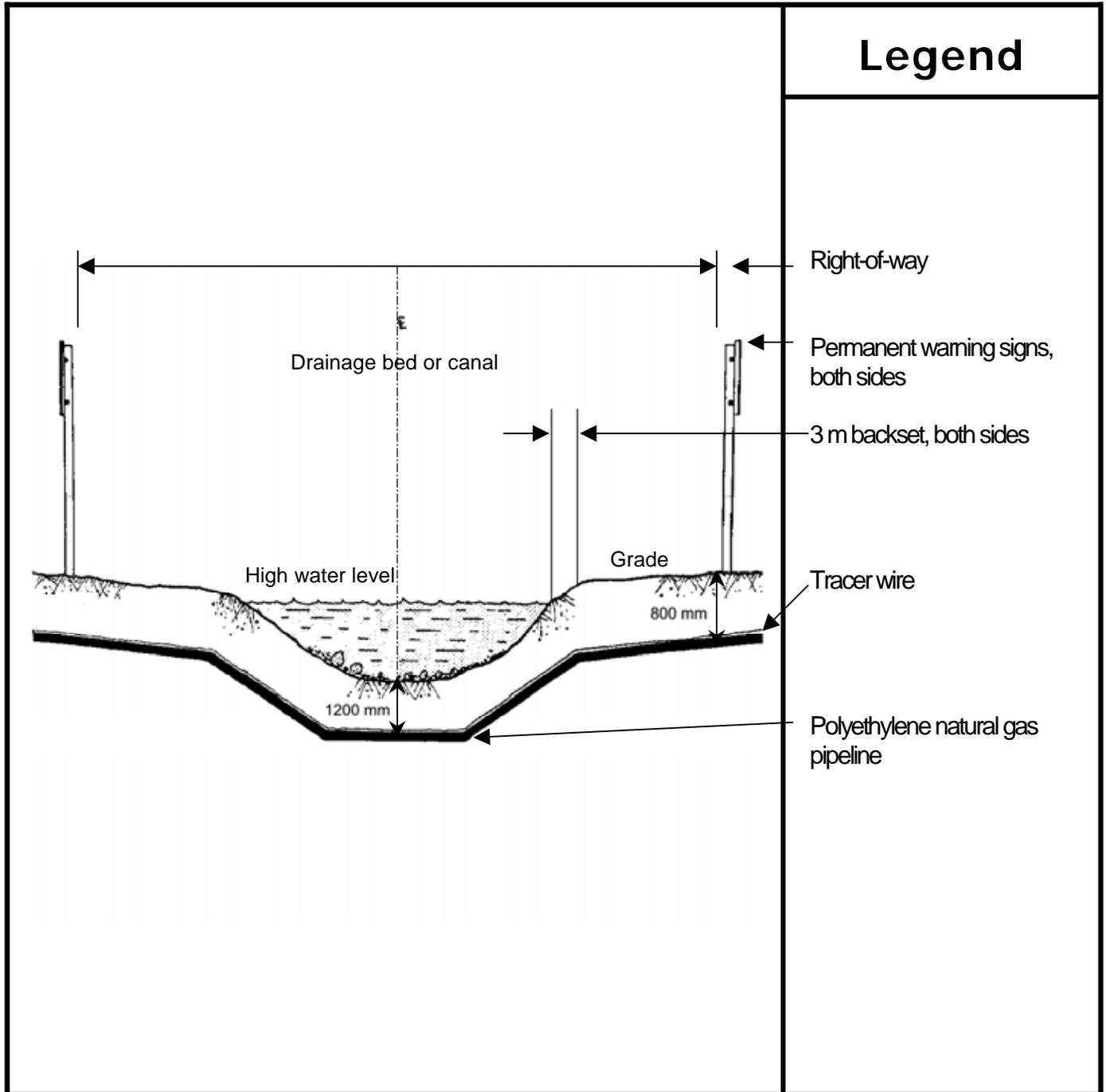


FIGURE 4.5 TYPICAL WATER/CANAL CROSSING

NOTES:

1. Minimum cover to be kept until 3 m 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)

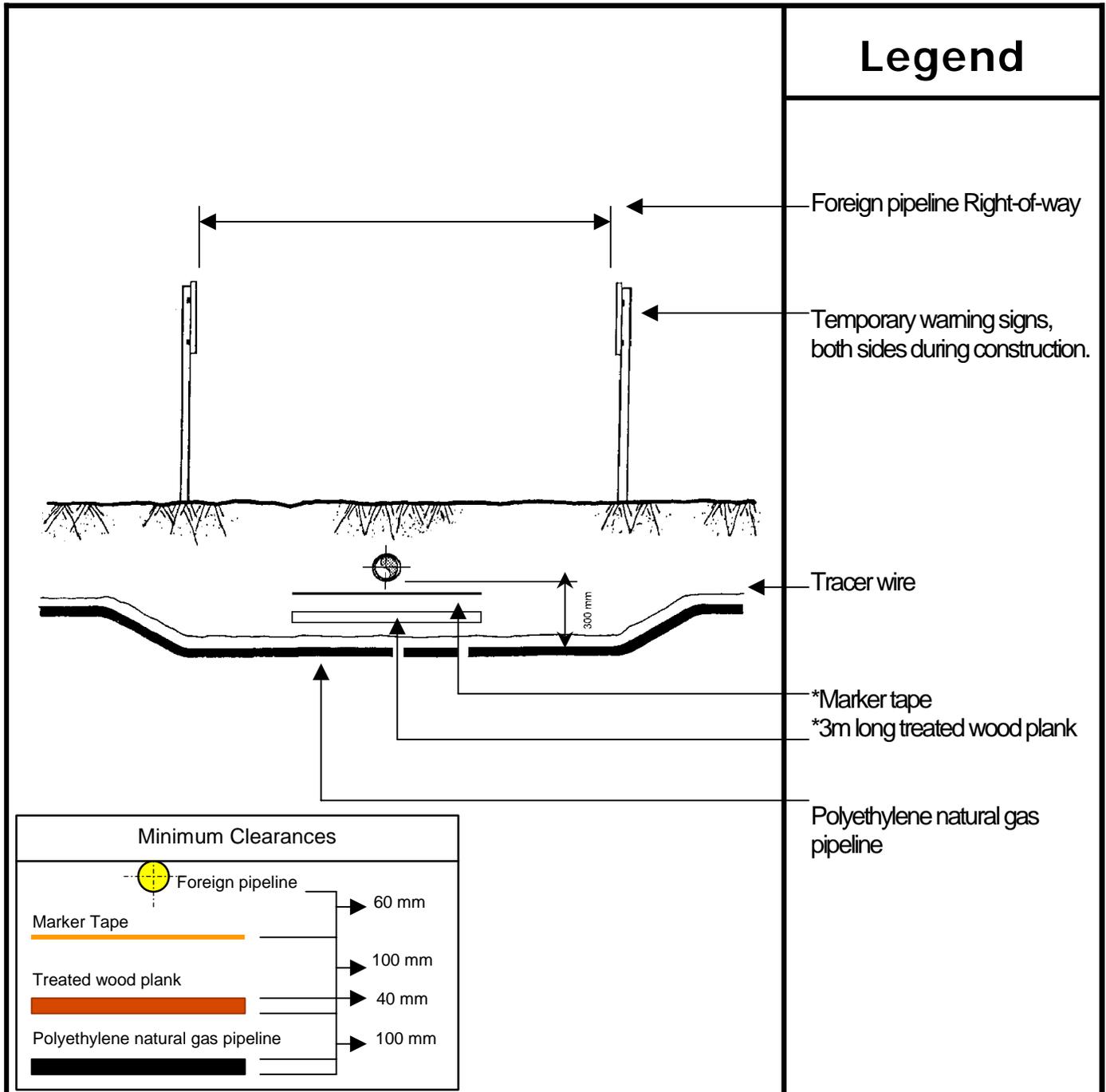


FIGURE 4.6 TYPICAL PIPELINE CROSSING

NOTES:

1. Foreign pipeline locations to be determined in the field.
2. *Installation of marker tape and treated wood plank is optional, unless specified by foreign pipeline owner

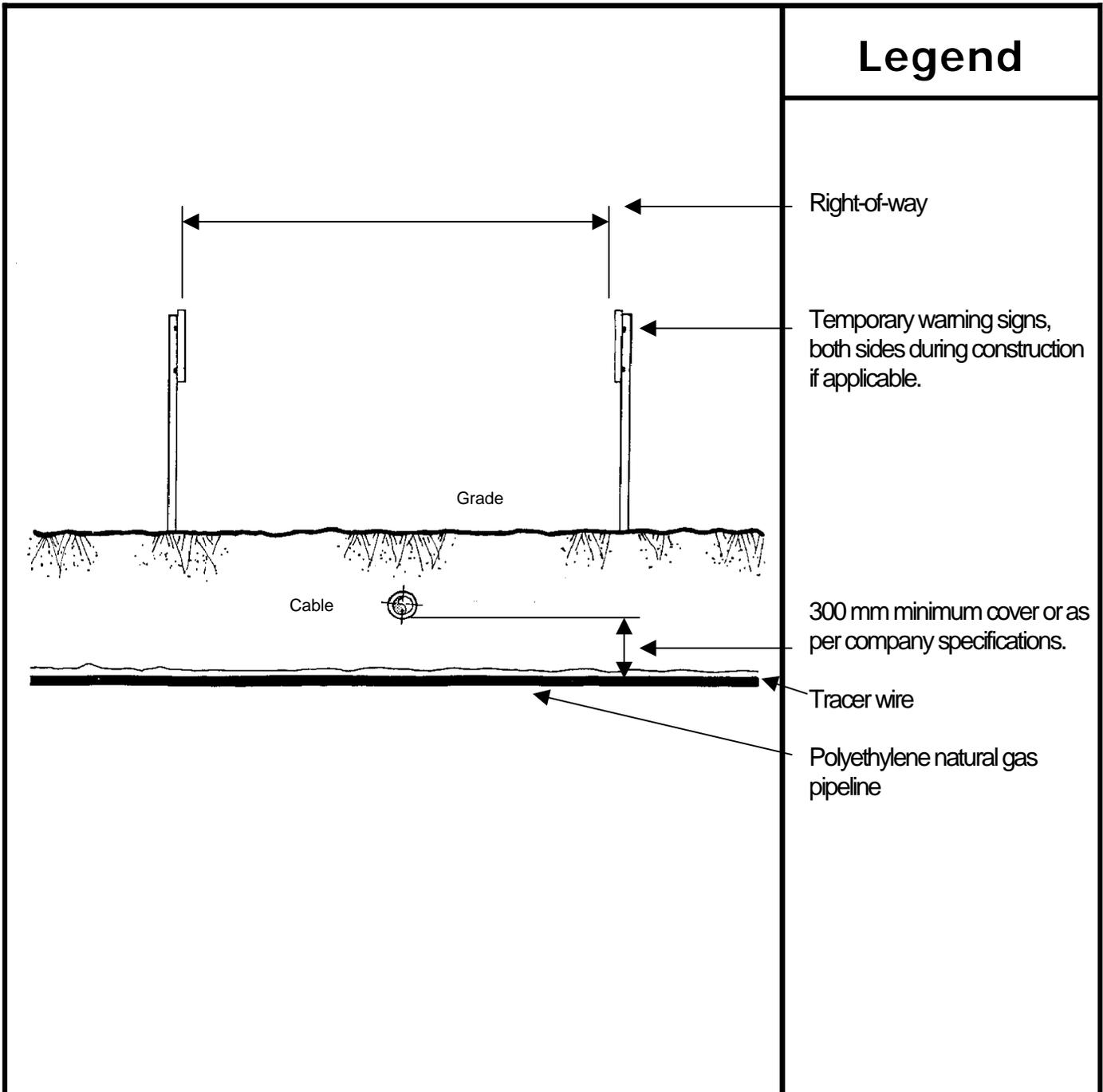


FIGURE 4.7 TYPICAL CABLE CROSSING

NOTES:

1. Temporary warning signs during construction are optional and depend on local conditions at time of installation.

4.8 Pipelines Parallel to Roads Administered by Counties and M.D.s

Municipal authorities are required from time to time to alter, widen or relocate the rights-of-way of roads that fall under their administration. Where a distribution pipeline exists parallel to and within proximity of the existing right-of-way of a road, the new design may require that the pipeline be relocated or lowered. While this is often unavoidable, good planning techniques can usually eliminate the need for future relocation or lowering. To facilitate good planning and avoid unnecessary pipeline relocation or lowering, a control area or zone as illustrated in Figure 4.8 should be used in the design of gas distribution systems.

For distribution pipelines operating at a pressure of 700 kPa or less, the control area concept should not be considered as a minimum distance parallel to and on either side of an existing road right-of-way in which the municipal authority has the inherent right to either approve or reject a pipeline installation (it should be noted, however, that the Pipeline Act does in fact require that high pressure pipelines to be constructed under that Act shall not be located within 30 meters of the boundary of a municipal road without the approval of the local authority).

The various control areas illustrated in Figure 4.8 should be used by a designer of a low-pressure distribution pipeline to consider future planning. If an initial design of a low-pressure pipeline paralleling a municipal road falls within one of the control areas illustrated, the designer should consider the following options:

- (a) Redesign the pipeline route such that it lies outside any control area.
- (b) Consult with the municipal authority to determine if there is likelihood that the road may be altered, widened or relocated such that the pipeline would be affected. If necessary, the pipeline route should be redesigned to avoid future conflict with road planning. If consultation with the municipal authority indicates that there is a good possibility that future road planning should not affect the proposed pipeline route, then that route may be retained.

These aspects are discussed in more detail in Appendix B.

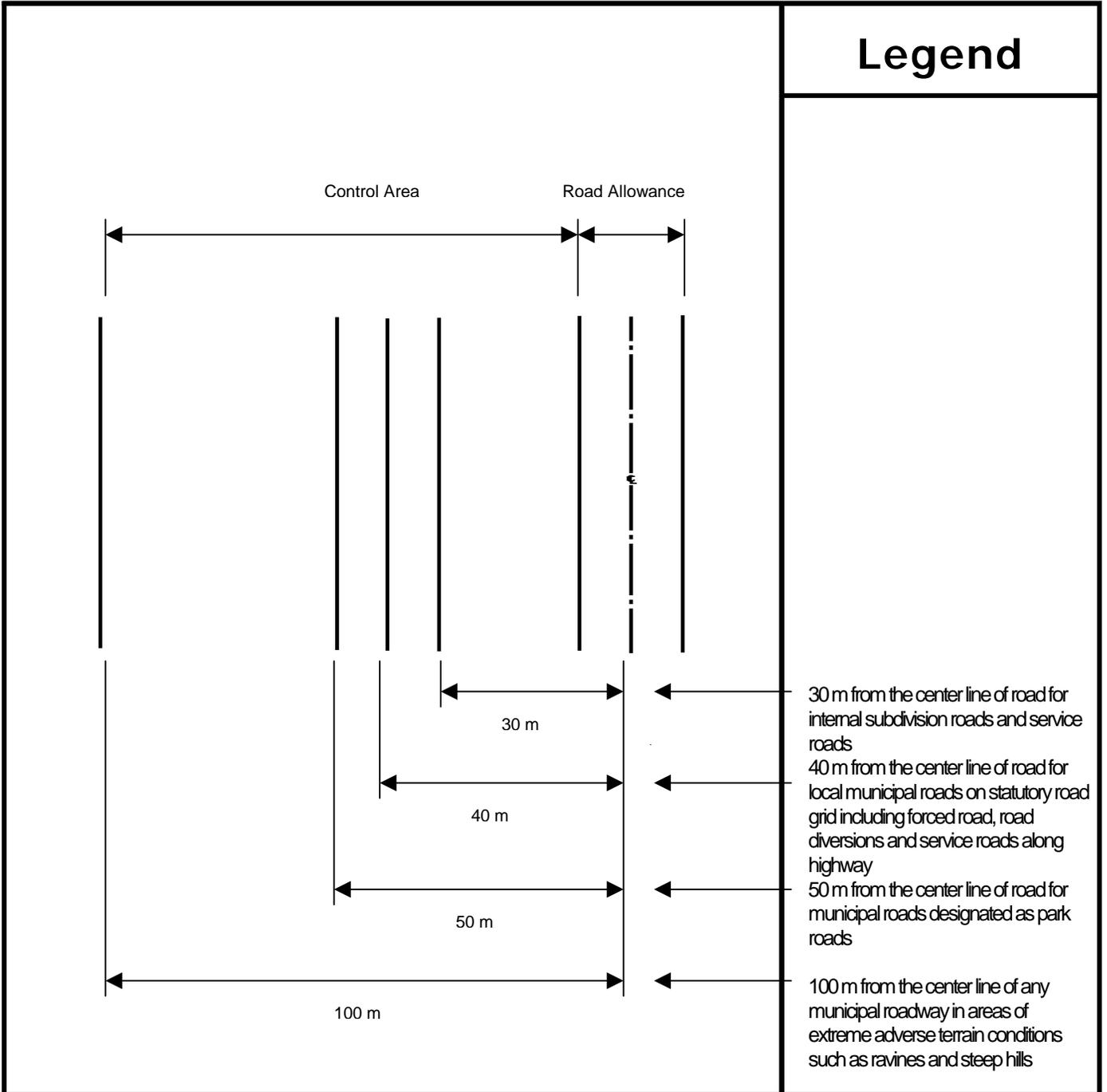


FIGURE 4.8 CONTROL AREA FOR PIPELINES PARALLEL TO LOCAL MUNICIPAL ROADS

NOTES:

1. Normal road allowance widenings may be equal on both sides because of terrain conditions or development constraints.
2. Control area is both of the sides of the center line of roadway.

4.9 Use of Road Rights-of-way as Pipeline Rights-of-way

The use of road rights-of-way as pipeline rights-of-way 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 bar 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 Figure 4.2 should be a vertical depth measured from the lowest point of the bar ditch as illustrated in Figure 4.9. 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. The maximum distance between warning signs should be approximately 300 meters.

This specification does not apply to pipeline installations within hamlets, subdivisions or incorporated urban areas.

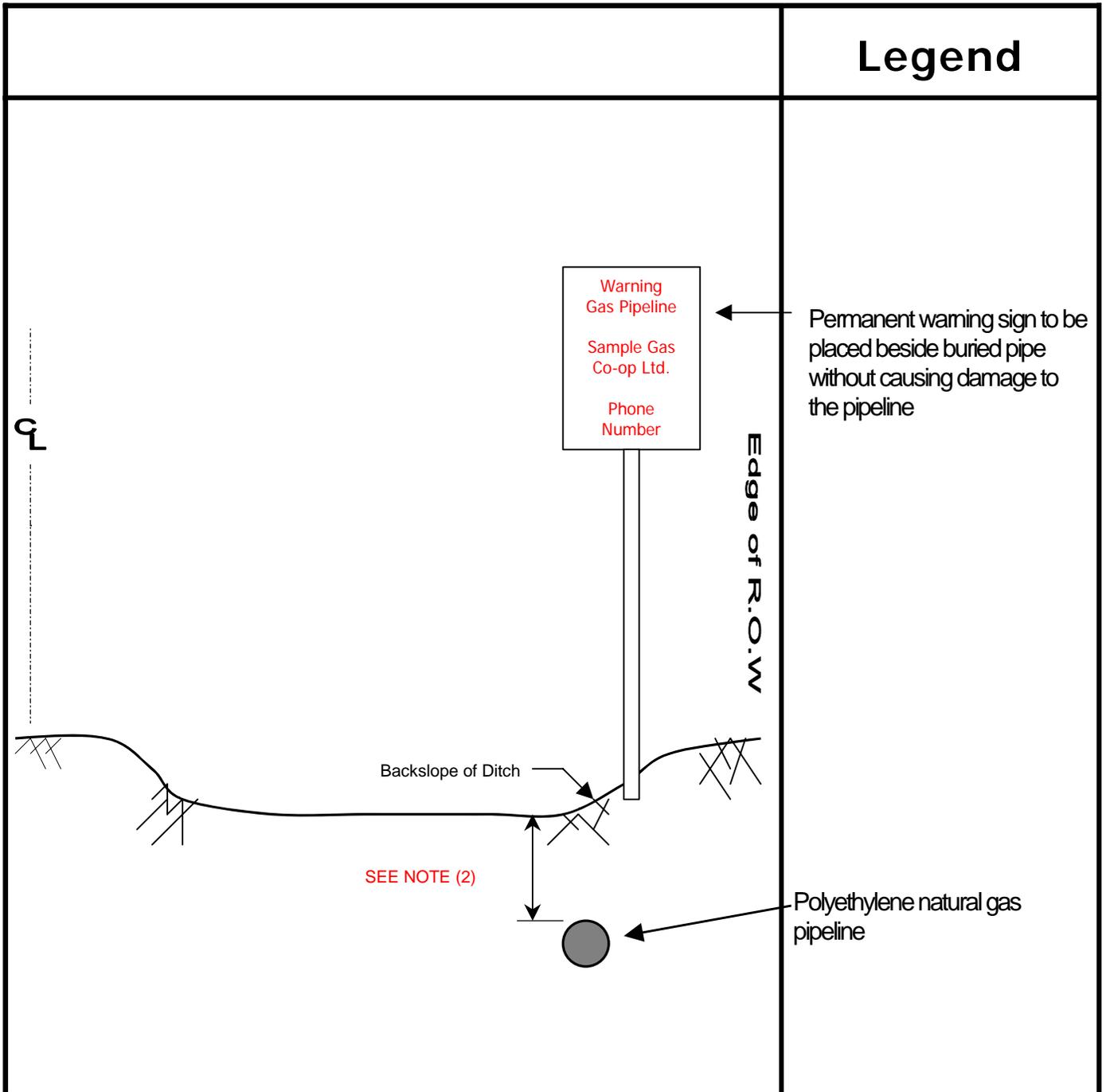


FIGURE 4.9 PIPE INSTALLATIONS IN RURAL ROAD/ HIGHWAY RIGHTS-OF-WAY

NOTES:

1. Maximum distance between warning signs shall be approximately 300 m.
2. Minimum depth of cover as outlined in Figure 4.2

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. Gas meters and ancillary instruments and controls must comply with the requirement of Measurement Canada. In addition, only polyethylene pipe, including the new PE100, which has been released for installation under the Division's Quality Assurance Program should be accepted for installation.

Materials should be selected in accordance with the following criteria:

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

Tracer wire manufactured from 14 gauge solid core copper wire with an extruded 0.8 mm (1/32") polyethylene coating should be installed simultaneously with polyethylene pipe. Below ground connectors for tracer wire should be specifically designed and manufactured to provide electrical continuity for the tracer wire. Experience has shown that cathodically protected tracer wire is beneficial.

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 a suitable manner such that damage to materials is prevented. Line pipe in particular should be protected by:

- (a) Ensuring that the vehicle is free of protruding nails or other sharp objects, which could damage the pipe.
- (b) Ensuring that the pipe is firmly secured and properly supported to prevent spillage from the vehicle.

Materials should be stored and handled in a suitable manner to prevent damage from mechanical handling equipment, other vehicles, and weather conditions. Line pipe should be stacked to a maximum height such that damage to bottom layers by crushing does not occur, and care should be taken to avoid exposing polyethylene pipe to direct sunlight for more than two years from date of production.

5.4 Project Management

Good project management techniques should be used to ensure that construction is carried out in an effective and efficient manner. Some of the responsibilities which a project manager is involved in include ensuring that:

- (a) 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) The necessary permits and approvals are obtained from any regulatory authority.
- (c) Any specific requirements of any permit or approval are complied with in all respects throughout the duration of the construction project.
- (d) Any specific requirements of any person or any agency which has provided a utility right-of-way are complied with in all respects.
- (e) Construction of the project is carried out in accordance with all applicable design plans, contract documents and crossing agreements.
- (f) Any damage to land and 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 or regulations.
- (g) Suitable procedures are used for crossing of foreign pipelines and cables and the specified requirements of the owners of foreign pipelines and cables are complied with in all respects. Some facility owners may require Ground Disturbance Training in accordance with IRP 17 (Industry Recognized Practice).

- (h) Suitable quality assurance procedures are developed and implemented for the handling, storage and installation of materials.
- (i) 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) 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) The person undertaking the construction project complies fully with all requirements of legislation and standards involved in the construction project.
- (l) The location and depth 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.
- (m) Landowners are satisfied that rights-of-way have been cleaned up and restored, and a release has been executed by the landowner before the contractor is relieved of his responsibilities in this regard.

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:

- (a) A utility right-of-way or similar instrument which can be registered against the appropriate land title (e.g. used for right-of-entry to private lands).
- (b) A legal agreement (e.g. used for crossings of roads, foreign pipelines, etc.).
- (c) Written authorization by 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 CAN/CSA standards, the Board and Alberta Municipal Affairs. All personnel handling and storing explosives must comply with the Provincial and Federal Acts and Regulations regarding explosives.

Only personnel performing high-energy joining are required to be re-qualified annually in accordance with CAN/CSA Z662 requirements and provincially developed procedures.

5.6.2 *Joining of Reinforced Thermoplastic Pipe*

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

5.6.3 *Fusion of Polyethylene Pipe (including PE100)*

Joining of PE100 pipe intended to operate over 700 kPa must be performed in accordance with Clause 13 of CAN/CSA Z662.

A person who intends to carry out fusion of polyethylene pipes must be trained and certified by an agency approved by the Division and must produce a current and valid certificate (ticket) upon request by a Division representative.

An agency may be approved 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) A good 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.
- (d) The proficiency to consistently make an acceptable socket, butt and saddle fusions using conventional or electrofusion equipment.

Certification is valid for two year from date of receipt provided the candidate has verified their level of proficiency through a field fusion send-in evaluation by any of the approved agencies. This verification must be completed within 16 months of formal certification. Certification may be continued by completion of an annual refresher course from any of the approved agencies.

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. Particular care should be taken when fusing two dissimilar materials.

The pocketbook size "Polyethylene Fusion Guide for Gas Distribution Pipe"(4th Edition January 2009) co-sponsored by the Division and a number of industry companies and training agencies is recommended for the use and reference to all persons who intend to perform polyethylene pipe fusions.

The fusion method should be used for polyethylene pipe jointing whenever possible. When an unknown pipe is found (i.e. CIL 219) use a sample of the pipe to make a test butt fusion with the new material. Allow an hour for test fusions to stabilize. If the bendback test fails, the use of a non-fusion fitting is recommended.

5.7 Pipeline Installations

Distribution pipelines should be installed in accordance with good engineering practice and in accordance with the CAN/CSA Z662 Standard. Care should be taken to avoid excessive stresses (e.g. polyethylene pipe should be “snaked” during installation to allow for contraction at low temperatures).

Polyethylene pipe should not be uncoiled and ploughed in where the pipe temperature is less than -7°C or as otherwise recommended by the pipe manufacturer. In addition, 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 encase the pipe in a protective material such as sand (see Figure 5.1).

5.8 Surface Installations

Temporary pipeline installations 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. Surface installations of high-pressure steel or aluminum pipelines require the prior approval of the Board.

Temporary surface installations of polyethylene pipe may be made on approval by the Division provided that the pipeline owner can demonstrate that the installation will be protected from damage during the period in service. Warning signs should be installed at specific distances to clearly identify the existence of the pipeline. The Division may also request other precautions.

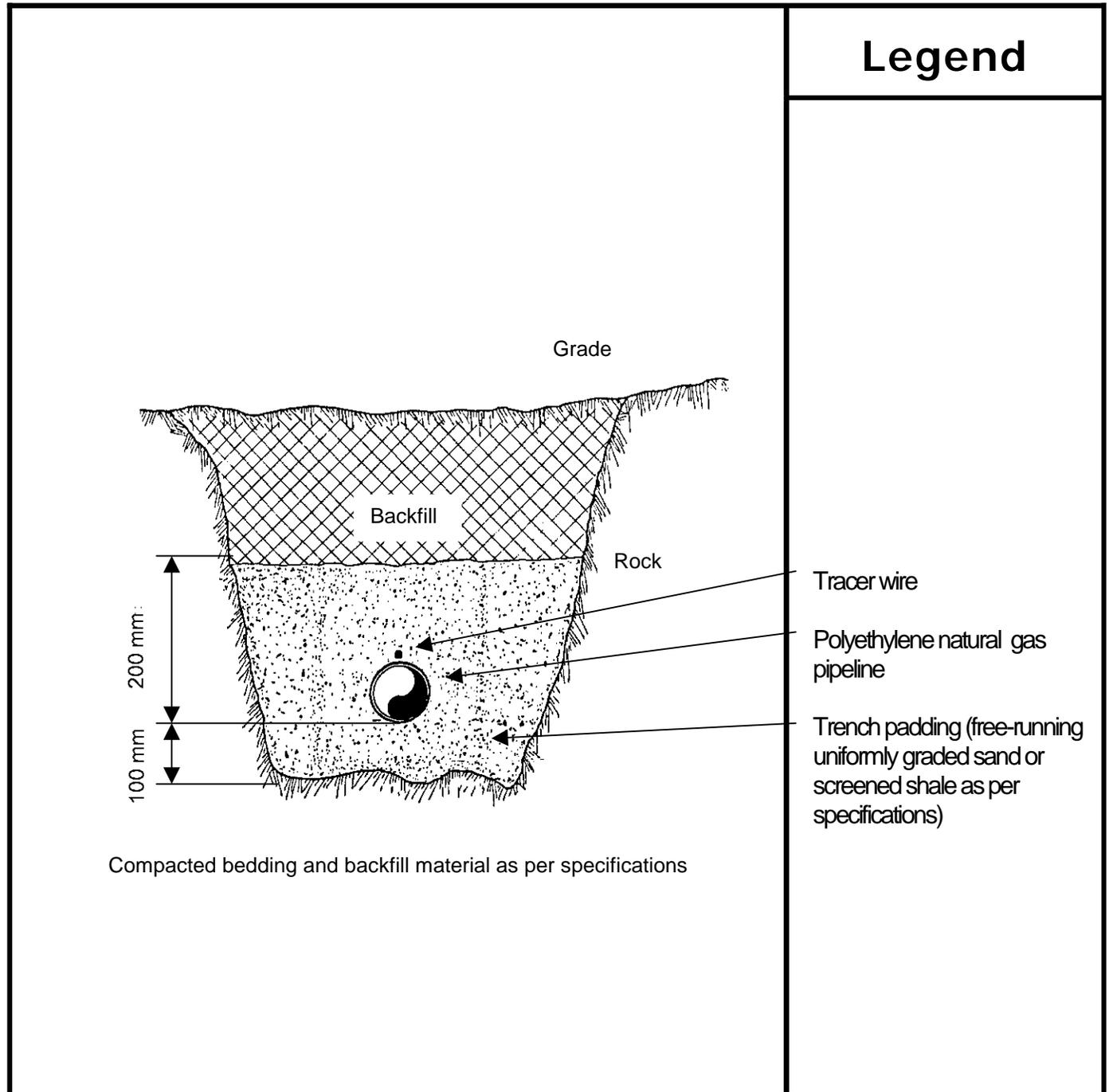


FIGURE 5.1 TYPICAL CROSS SECTION FOR SAND-PADDED ROCK DITCH

NOTES:

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 outside 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 CAN/CSA Z662 Standard, latest edition, and may be subject to approval by the Division. Warning signs for high-pressure pipelines must meet the new requirements of the Board.

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. Where appropriate, consideration should be given to making provision for determining the depth of cover over a pipeline adjacent to a warning sign.

5.10 Domestic Meter Installations

Domestic meter installation should be installed in a manner that will avoid excessive stress on the meter, piping and ancillary equipment. The location of domestic meter sets should, if possible, be outside buildings and 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).

In accordance with CSA B149 and the new Alberta Gas Code regulation, no mechanical transition fittings (steel to polyethylene) are to be within 4.6 metres (15 feet) of a building.

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.

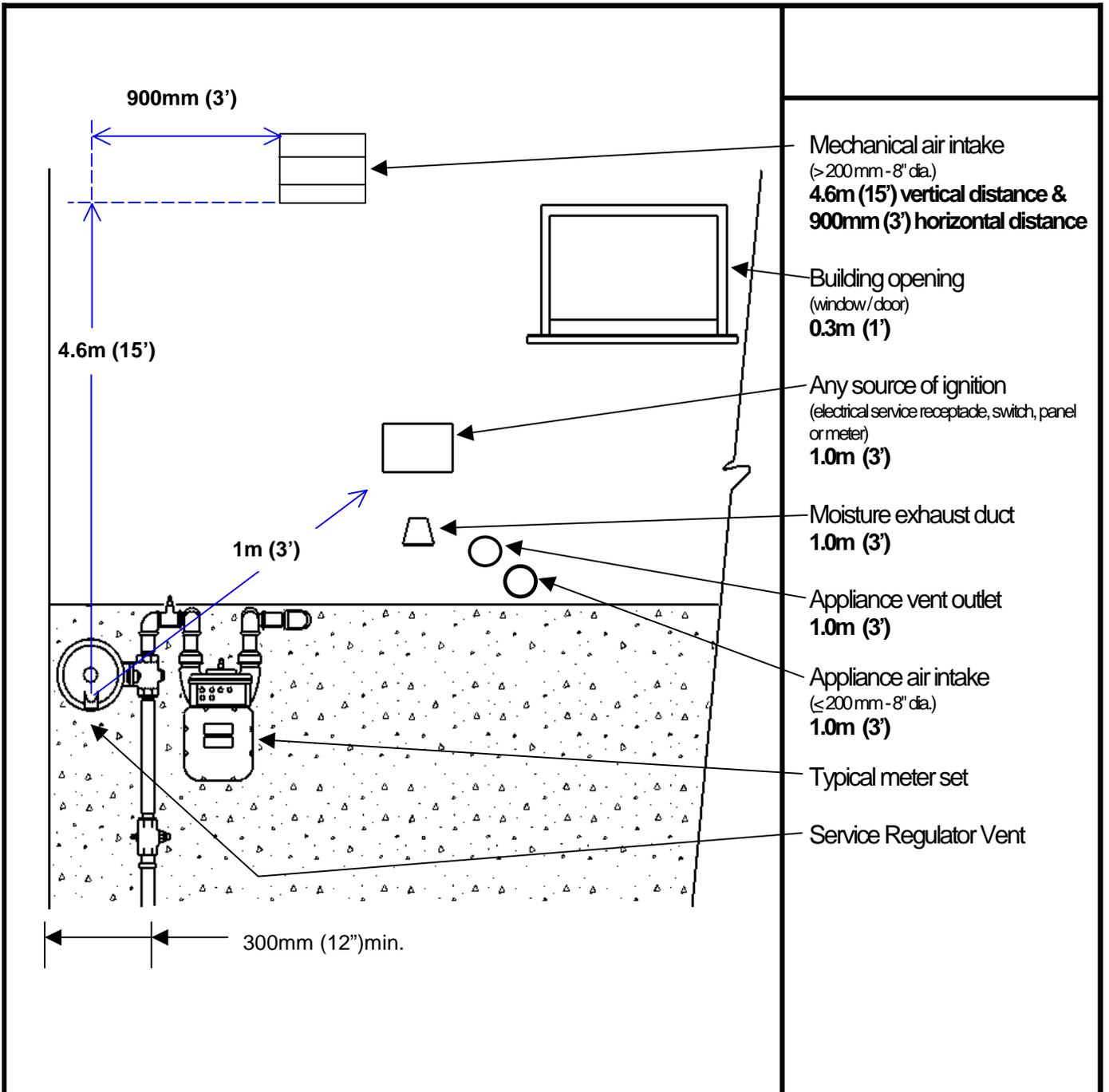
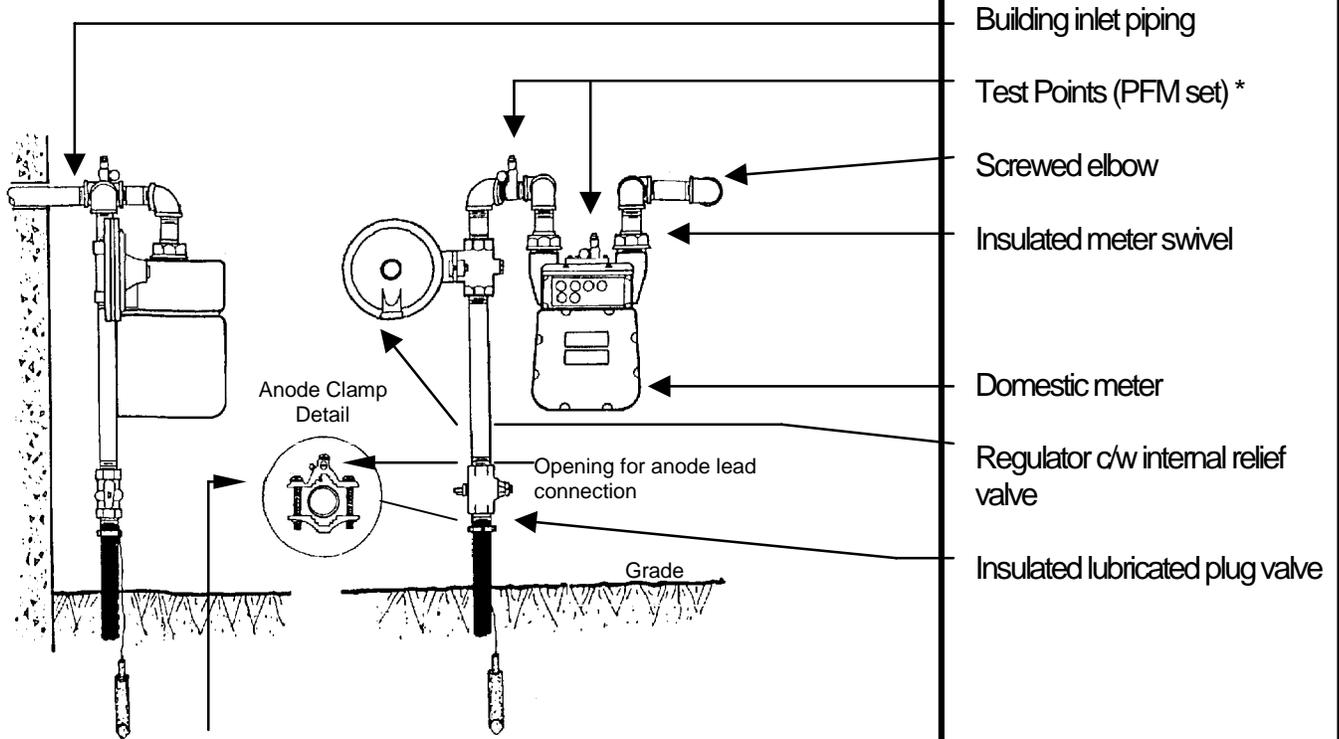


FIGURE 5.2 LOCATION OF REG. VENT RELATIVE TO BUILDING OPENINGS

NOTES:

1. All clearances listed are in accordance with CSA B149.1-10 Clause 8.14.8.
2. If these clearances cannot be met, CSA 6.22 regulator/relief may be used. See Table 5.2 in CSA B149.1-10 for acceptable clearances.

Legend



Self-tapping screw to be screwed thru the coating on the prefabricated riser

FIGURE 5.3 TYPICAL DOMESTIC METER SET

NOTES:

* - On PFM installations, downstream low-pressure regulator is required.

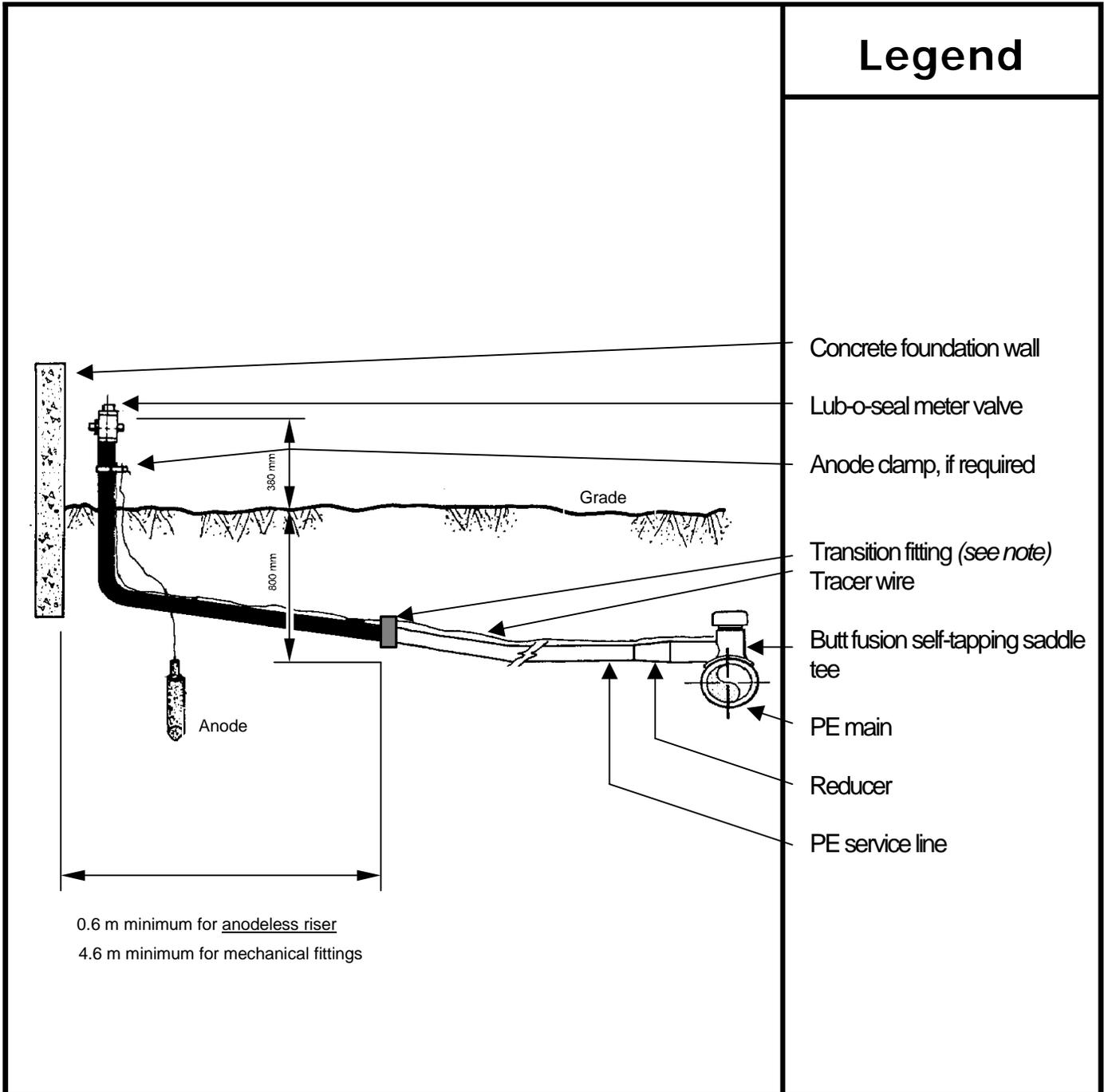


FIGURE 5.4 TYPICAL RISER ASSEMBLY

NOTES:

In accordance with CSA B149 and the new Alberta Gas Code regulation, mechanical transition fittings (steel to polyethylene) are NOT PERMITTED within 4.6 metres (15 feet) of a building.

5.11 Cathodic Protection

Pipelines and appurtenances that are subject to corrosion due to electrochemical conditions must be adequately protected from such corrosion and should be designed and installed by a person knowledgeable in that field.

Metallic pipeline 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. 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 simultaneous with the installation of the pipeline system to be protected, except in circumstances where it is necessary or advisable to allow adequate settlement of trench backfill prior to the measurement of pipe-to-soil electrical potential.

Experience has shown that cathodically protected tracer wire is beneficial in natural gas pipeline distribution systems.

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

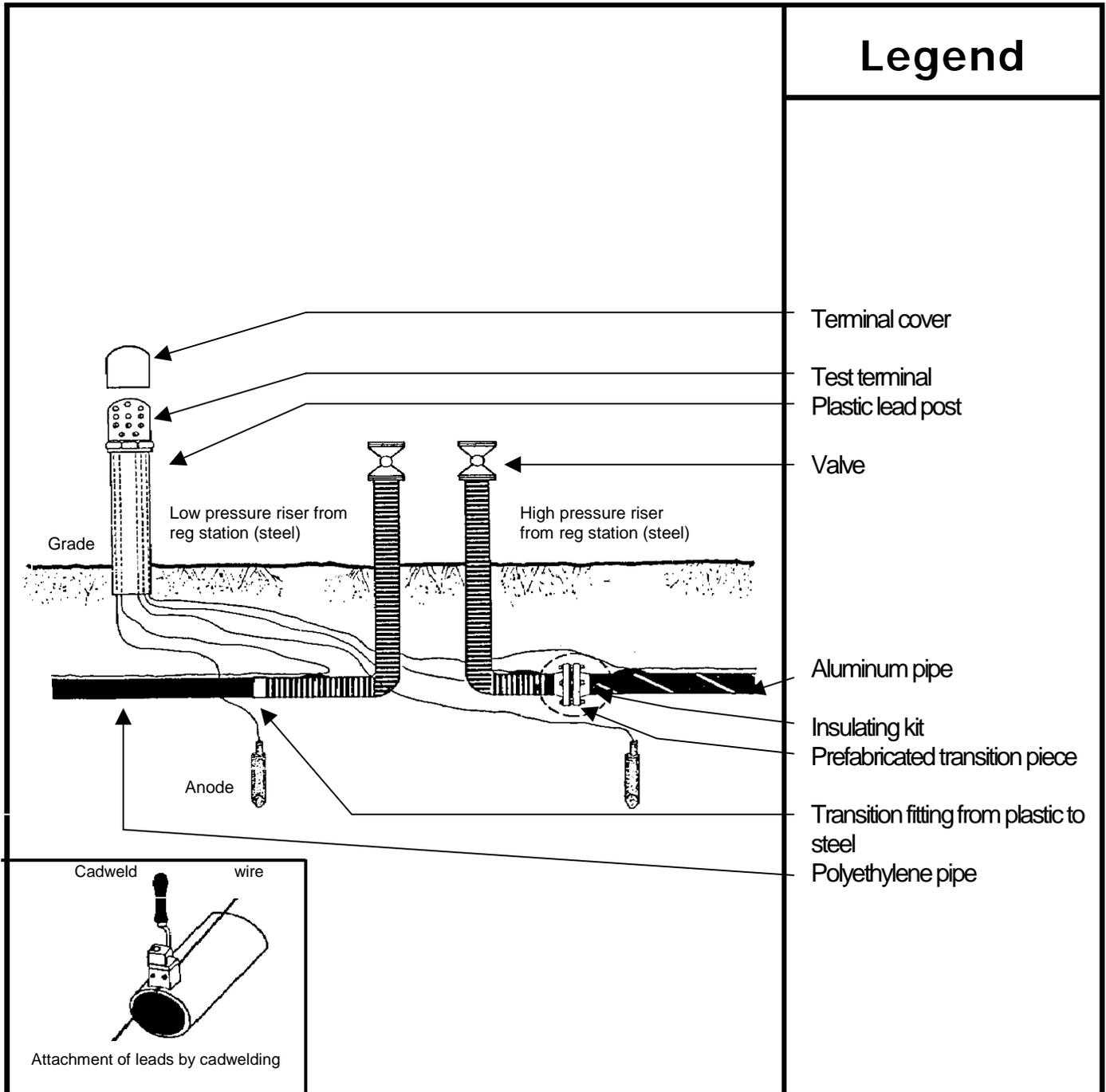


FIGURE 5.5 TYPICAL TEST STATION C/W ANODE INSTALLATION

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.

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 system. The location of these facilities is of principal concern since regulator stations and isolation valve assemblies should be adjacent to suitable access 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.

Each facility should be provided with:

- (a) Adequate structural support to prevent excessive stress on station and inlet/outlet piping.
- (b) Where applicable, 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 system, which is being served. In selecting from these options, the designer should attempt to carefully balance the layout and equipment needed to facilitate good operational features against the capital costs of the station.

Pressure regulator stations should include sufficient ancillary fittings to provide for pressure gauges, swing joints, relief valves and accounting meters (“Pop” type relief valves should not be used).

Selection of the number and type of pressure regulators should 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. 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 recommended that provision be made for accounting meters in all designs.

Legend

1. Regulator
2. Relief valve
3. Ball valve
4. Tee
5. Elbow
6. Union
7. Bull plug
8. Nipple

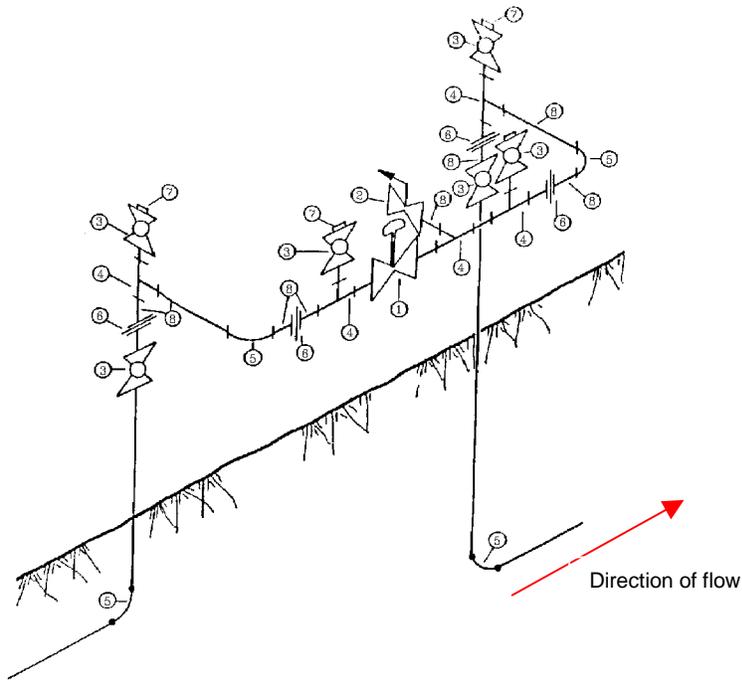


FIGURE 6.1 TYPICAL SINGLE RUN, SINGLE CUT REGULATOR STATION

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 outside.

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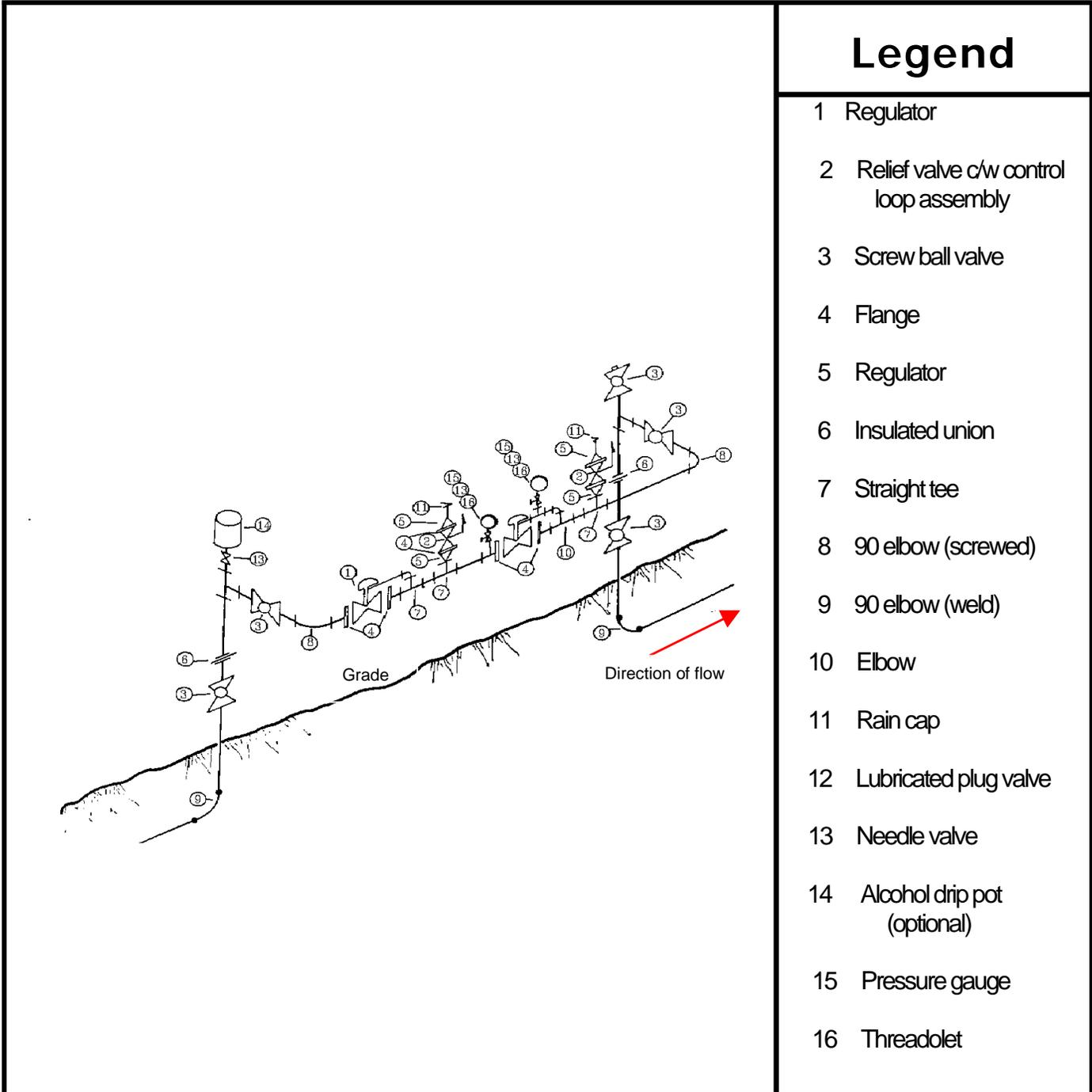


FIGURE 6.2 TYPICAL SINGLE RUN, DOUBLE CUT REGULATOR STATION

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 outside.

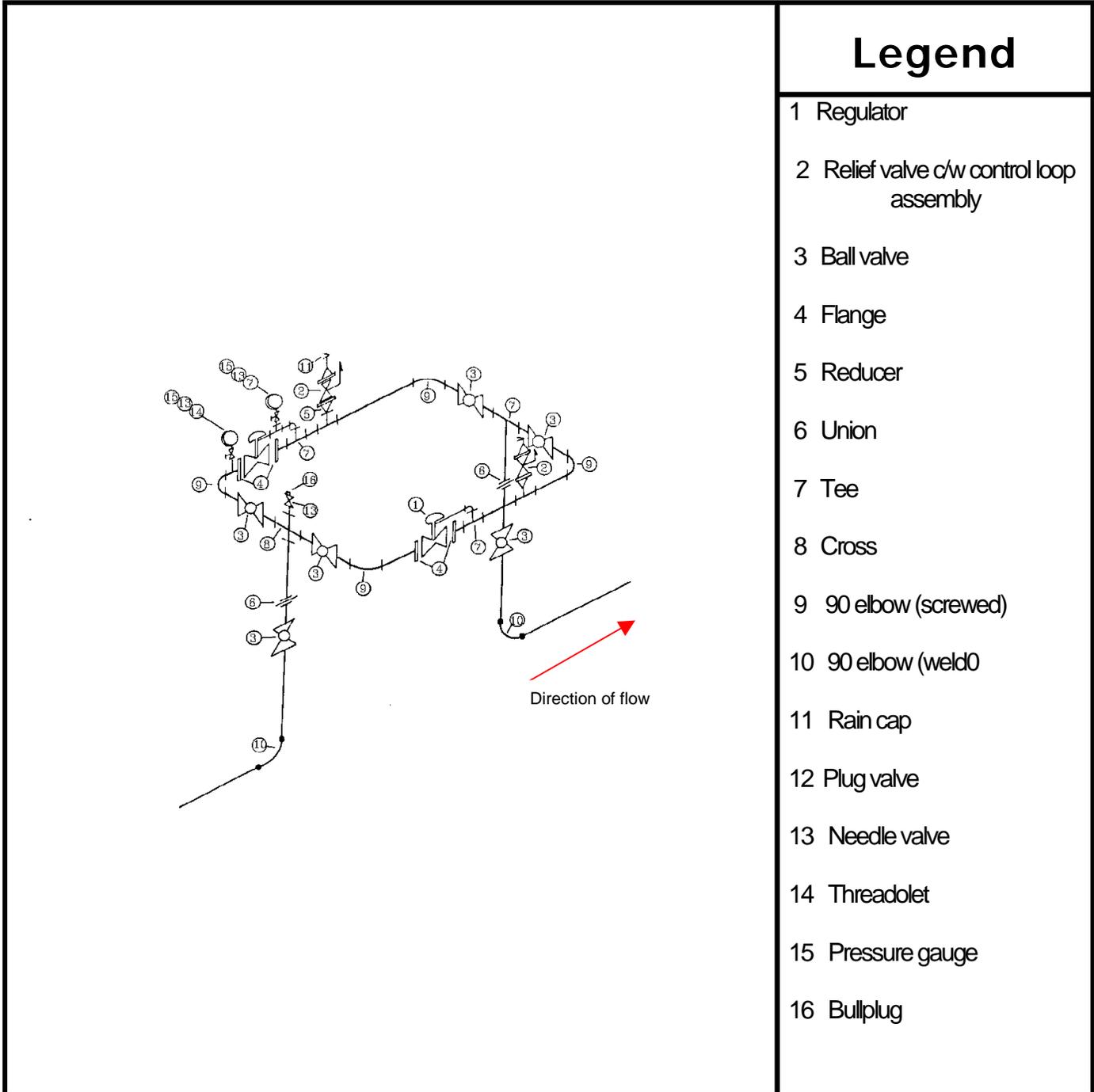


FIGURE 6.3 TYPICAL DOUBLE RUN, SINGLE CUT REGULATOR STATION

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 outside.

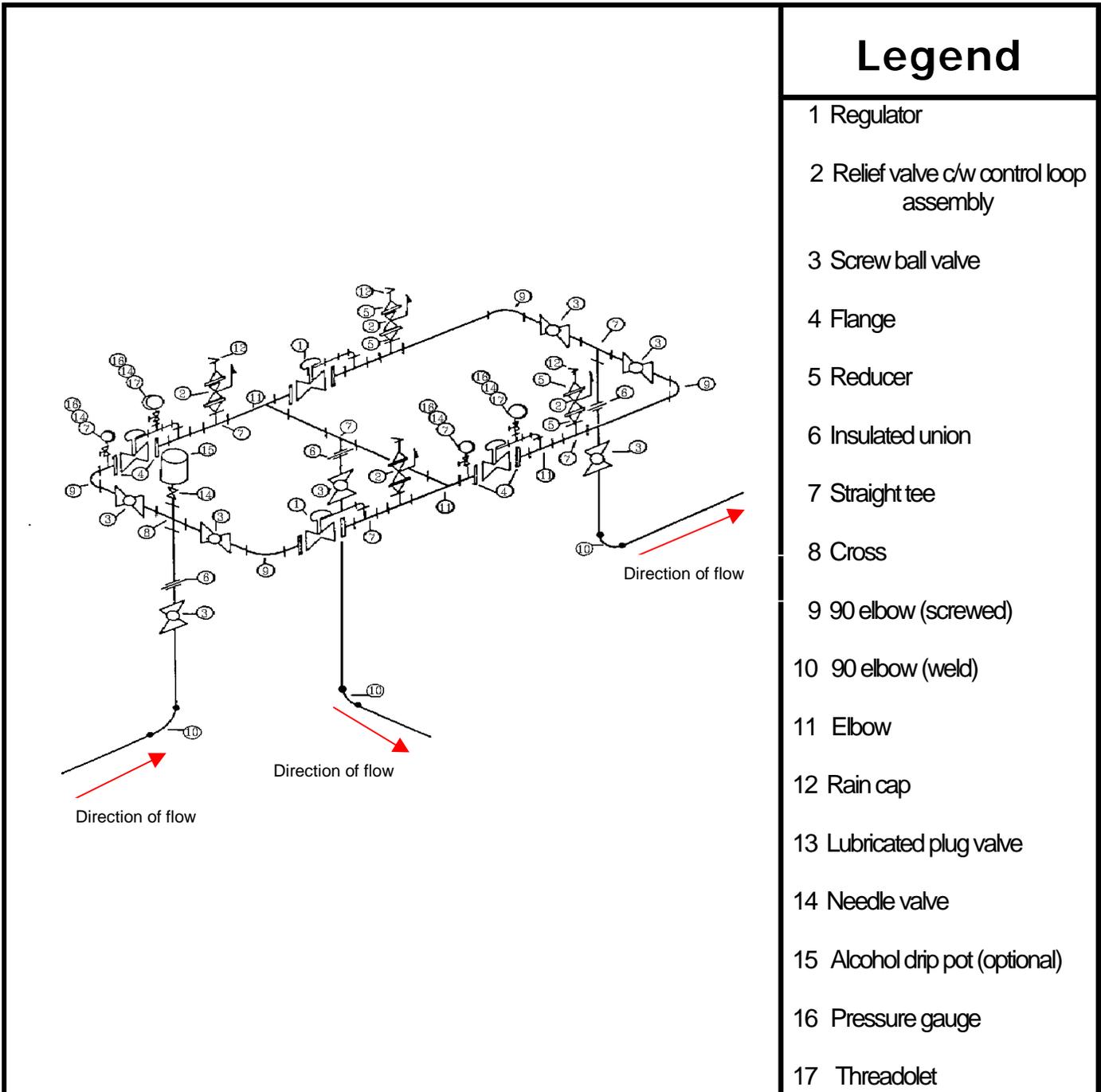


FIGURE 6.4 TYPICAL DOUBLE RUN, DOUBLE CUT REGULATOR STATION

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 outside.

6.3 Isolation Valve Assemblies

Isolation valves should be strategically located to permit damaged or ruptured segments of distribution 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, the line-pack capability of the downstream system, and the terrain.

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 more restricted. However, 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.

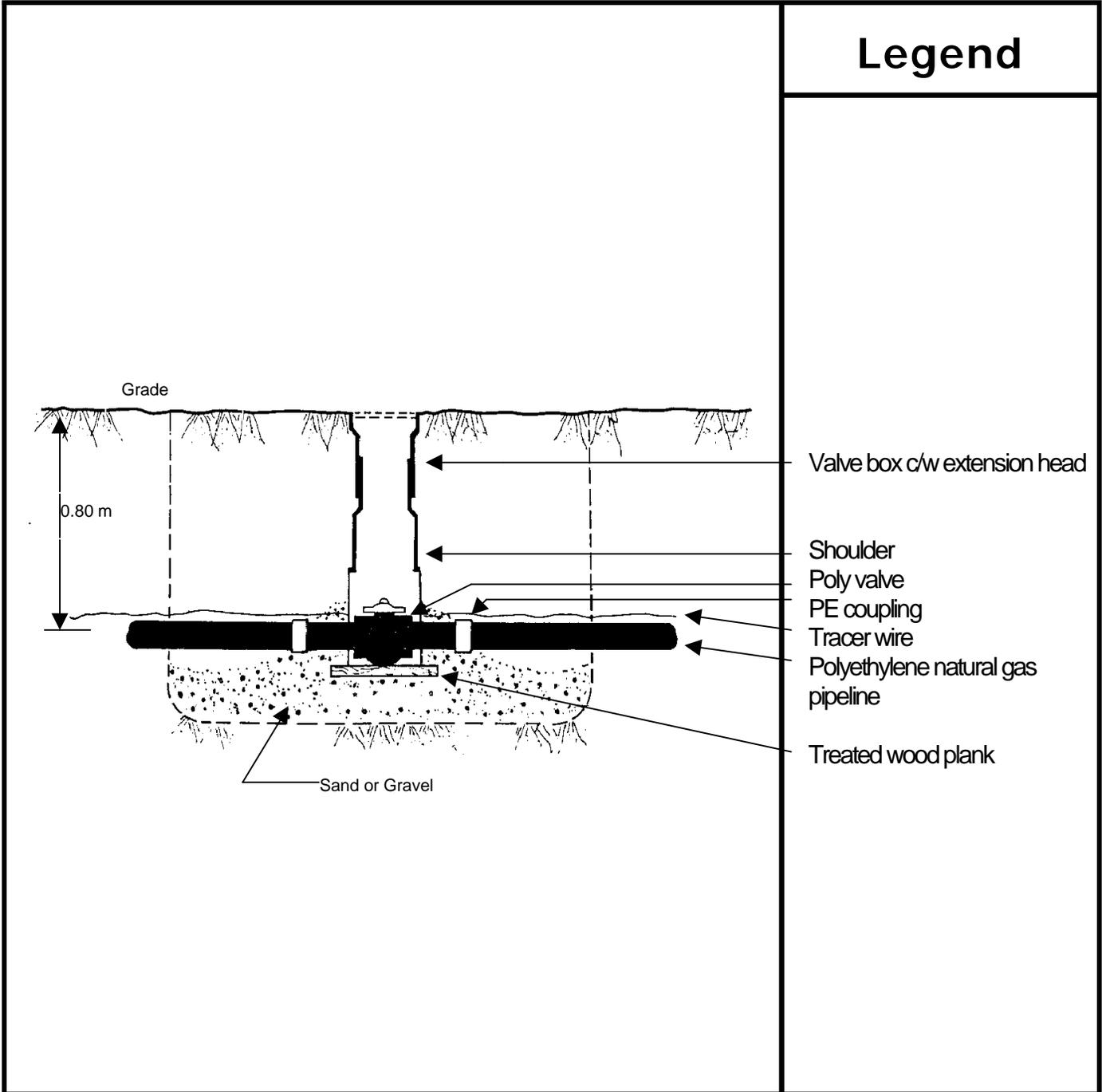
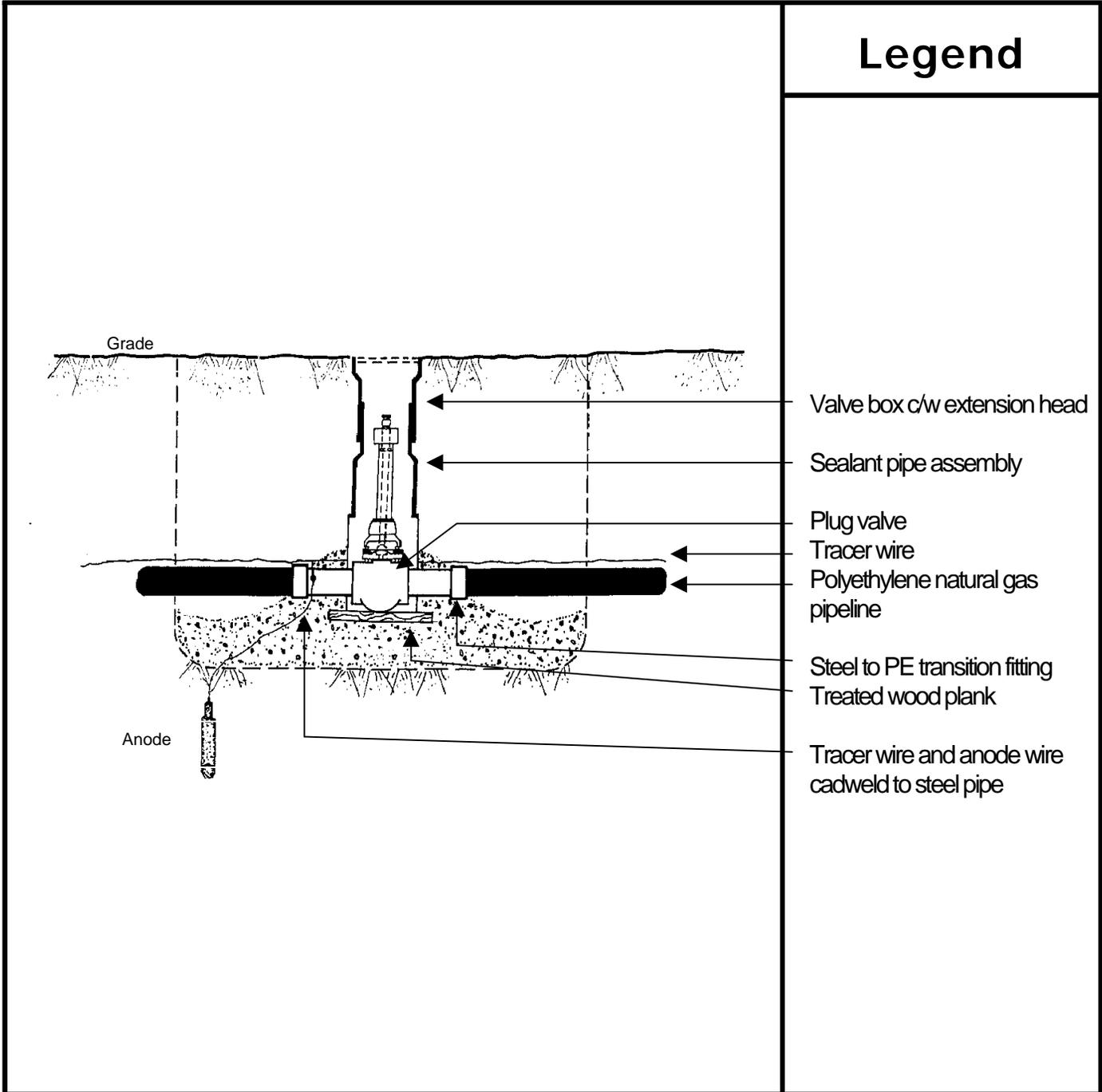


FIGURE 6.5 TYPICAL UNDERGROUND POLYETHYLENE ISOLATION VALVE ASSEMBLY

NOTES:

1. Marker post to be placed within 0.25 m of valve assembly



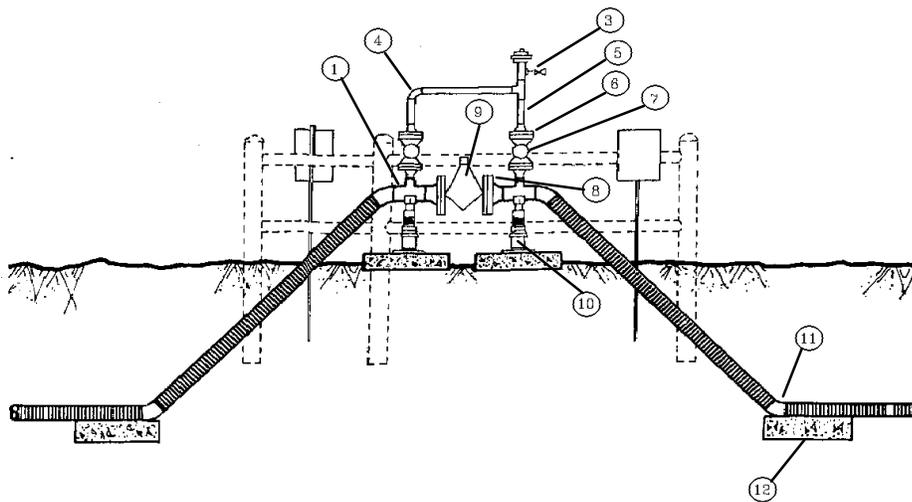
Legend

FIGURE 6.6 TYPICAL UNDERGROUND STEEL ISOLATION VALVE ASSEMBLY

NOTES:

1. Marker post to be placed within 0.25 m of valve assembly

Legend



- 1 Standard butt weld tee
- 3 Thredolet c/w instrument valve
- 4 90 LR elbow standard butt weld
- 5 Seamless pipe
- 6 Weld neck flange
- 7 Flanged ball valve
- 8 ANSI flexitallic flange
- 9 Plug valve
- 10 Adjustable pipe saddle support
- 11 45 elbow standard butt weld
- 12 Concrete supports

FIGURE 6.7 TYPICAL ABOVE GROUND H.P. STEEL ISOLATION VALVE ASSEMBLY

NOTES:

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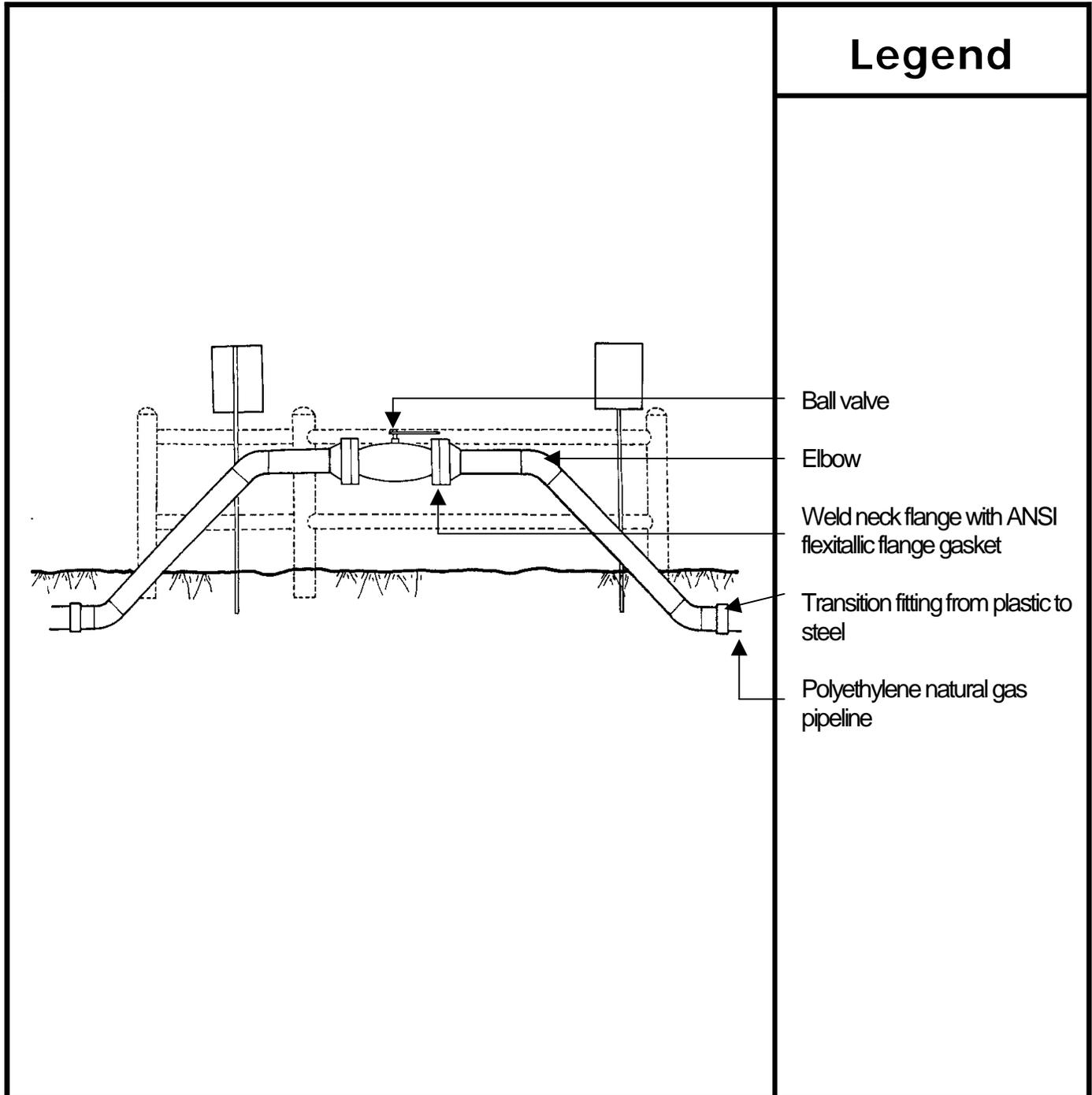


FIGURE 6.8 TYPICAL ABOVE GROUND POLYETHYLENE ISOLATION VALVE ASSEMBLY

NOTES:

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 Board.

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.

With respect to new pipeline systems, polyethylene materials currently used in Canada to produce gas pipe are all rated to a maximum “hydrostatic design basis” of 8.62 MegaPascals (MPa) at 23°C. Accordingly, the design formula for polyethylene pipe from the CAN/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 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 CAN/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 CAN/CSA Z662 (i.e. PE100 and RTP 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. Calculate duration using the spreadsheet on the Division website or duration should not be less than the following:

Length of Pipeline Under Test	Minimum Test Duration	Type of Press. Recording Device
< 100 m, & ≤ 33.4 mm O.D.	30 minutes	Pressure Gauge
< 2000 m, & ≤ 60.3 mm O.D.	4 hours	Chart Recorder
< 6000 m, & ≤ 60.3 mm O.D.	12 hours	Chart Recorder
< 12000 m, & ≤ 60.3 mm O.D.	24 hours	Chart Recorder
< 5500 m, & ≤ 88.3 mm O.D.	24 hours	Chart Recorder
< 3200 m, & ≤ 114.3 mm O.D.	24 hours	Chart Recorder

Division website spreadsheet – (Test Duration.xls):

<u>Spreadsheet for calculating duration for multiple sizes and lengths test</u>				<u>Spreadsheet for calculating Max. length of line for specific Size & Duration.</u>			
Pipe Talley Nominal sizes 20PE - 3/4" 25PE - 1" 32PE - 1 1/4" 38PE - 1 1/2" 50PE - 2" 75PE - 3" 100PE - 4"	Input Table			Pipe O.D. (mm) SDR Test Pressure (psig) Base Pressure (psi) Atmospheric Pressure (psi) Duration (hr.) Max. Press. Loss % Max. Press. Loss (psi) Acceptable Loss Rate (cfh)	Input Table		
	OD mm	DR	Quantity (M)	60.3	11	112	14.73
	26.7	11		13.60	4	2.7%	3.0
	33.4	11		7.0	7.0	Acceptable	Acceptable
	42.2	10		3.0	3.0	standard	standard
	48.3	11	2000	7.0	7.0	base	base
	60.3	11		3.9	3.9	conditions	conditions
	88.9	11		2036	2036		
	114.3	11					
	<i>Internal Volume (M³) -</i>			3.82			
Base Pressure (psi)	14.73	14.73	Acceptable standard base conditions				
Max. Press. Loss (psi)	3.0	3.0					
Acceptable Loss Rate (cfh)	7.0	7.0					
Test Duration (hr.)	3.9 (236 minutes)			Max Length (M)	2036		
Quick Conversions:							
<i>FEET</i>		to	<i>METRES</i>				
0							
<i>KPA</i>		to	<i>PSI</i>				
0							
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)							

Test results should be recorded on the test chart or the "Pipeline Test Confirmation" form shown in Figure 7.1 and maintained with the distributor's as-built information as per Clause 8.7 of CAN/CSA Z662-11. The information recorded on the test chart should include the following information:

TEST CHART INFORMATION

P/L TO Location _____

Pipe Reel #s _____

Pipe Size(s) _____ Resin: _____

Extruder: _____ Yr. Extruded _____

DR # _____ Pres. @ End of Test _____ psig/kPa

Test Verified By: _____

The above chart was designed to be added as a stamp or adhesive label to the test chart or work order.

7.5 Increasing the Maximum Operating Pressure

Where a low-pressure pipeline was previously designed/licensed to an operating pressure less than the maximum permitted in CAN/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 Division. 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 (should be at least 1.4 times the operating pressure being considered), the service history of the pipeline system and the projected service life of the pipe material.

Procedures for increasing MOP are listed in CAN/CSA Z662 Clause 10.

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 Surveys and Plant Location Records

8.1 General

Buried distribution pipelines must be accurately surveyed and plotted on plant location records for a number of reasons, including the following:

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

The second factor listed is obviously the most important since it involves a high degree of potential for loss of life, personal injury, and/or property damage. Accordingly, 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 through recognized survey techniques and, finally, preparing plant location records to serve as a permanent record of pipeline locations.

8.2 Pre-Construction Surveys (Design and Route)

A pre-construction survey should be carried out to ensure that:

- (a) Pipeline and plant will be located in accordance with design plans.
- (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 designs.
- (d) Any specific requirements in a utility right-of-way agreement, such as routing of pipelines in accordance with a landowner's specifications, are followed.
- (e) The person undertaking construction of the pipelines and plant is provided with a surveyed and staked out route to follow in order that deviations from design plans are minimized.

Where a pre-construction survey reveals that a more practical and efficient routing is available, the surveyor may stake this alternative routing provided that it falls within the limitations of the utility right-of-way agreement, the permit issued by the Board, construction approvals issued by the Division, and point (b) above is reevaluated.

8.3 As-Built Surveys

Following construction, the actual location of a buried distribution pipeline should 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 *High Pressure Pipelines*

Due to the additional potential hazard which exists in high pressure pipelines, the survey standards for such pipelines must be more precise and, accordingly, the survey should meet survey accuracy attainable by Global Positioning Surveys technology (GPS). The Board has issued a waiver to the requirements for a legal survey of high-pressure pipelines to the Federation of Alberta Gas Co-ops (letter dated March 26, 2010)

- (a) The survey equipment to be used must be capable of achieving precision to ± 1 metre.
- (b) Both ends of the pipeline being surveyed must be tied into the nearest available survey evidence.
- (c) Distances and bearings along the pipeline's route between transit stations, the intersection of property lines, and right-of-way boundaries must be included in the survey notes. (A GPS data file can be retained in lieu of written survey notes.)
- (c) A tie to the northeast (NE) corner of every section must be collected. If there is no survey evidence in these locations, the tie can be collected to the closest evidence available. These distances and bearings should be referenced to the existing survey systems.
- (d) All high-pressure risers must be identified and tied to the nearest survey evidence.
- (e) Where the ditch line is not visible at the time of survey, the pipeline must be located with a dependable pipe-locating device.
- (f) The pipeline should always lie within one metre horizontal distance of the line of survey, except where a pipeline has been placed in an irregular arc (e.g. ploughed aluminum pipeline) in which case the pipeline must lay within three metres horizontal distance of the line of survey. The pipeline must be shown within the correct parcel of land at all times.

8.3.2 *Low Pressure Pipelines*

- (a) The survey equipment to be used must be capable of achieving precision to ± 3 metres. (GPS is the industry best practice)
- (b) Distances and bearings along the pipeline route between turning points and property lines must be included in the survey notes. (A GPS data file can be retained in lieu of written survey notes.)

- (c) GPS surveys should be aligned by taking a recording at the point of the nearest available survey evidence.
- (d) Where a definite ditch line is not visible at the time of survey, the pipeline must be located with a dependable pipe-locating device.
- (e) The actual location of the pipeline should always lie within two metres horizontal distance of the line of survey provided that the pipeline is shown within the correct parcel of land at all times.

8.4 Plant Location Records

The location of distribution pipelines or other plant, either buried or installed above ground, must be accurately recorded for the reasons described in Section 8.1 and, in particular, to ensure against the possibility that buried pipelines cannot be located in a field survey.

Plant location records are prepared and submitted to the Division prior to March 31 of each calendar year. This submission includes the digital mapping files and a listing of all construction activity for the year.

The Division supplies PDF files to the ERCB Records Services in Calgary of the Gas Co-op and Municipally-owned Gas Utility plant records. The Division supplies digital low-pressure pipeline information from all natural gas distributors to various pipeline search companies within the province.

Plant location records comprise of two primary elements – *digital mapping files* and *relevant documents*.

8.4.1 Digital Mapping Files

Digital mapping files are compiled in accordance with the “Standards Manual for Digital Mapping Plans” which is available from the Division. The individual rural gas distributors are responsible for maintaining their mapping files. The Division acts as a repository of the files and annually provides the records to the ERCB for distribution.

Digital Mapping files are submitted to the Division in Bentley MicroStation® CAD format.

A complete set of digital plant location records consist of the following:

1. Subdivision/area detail plans – 300, 400 and 500 series drawings (LND & UTL) indicates a greater detail of gas utility distribution system in rural subdivisions, urban areas and details of congested areas on the township drawings.
2. Township plans – 1:20 000 scale drawings (LND & UTL) indicates an overall plan encompassing one entire township of the distributor’s franchise area.
3. Sheet file – A sheet surround file that contains a border, general notes and a key plan used in conjunction with the township plans.
4. Infill files – Supplementary files showing all the utility construction activities within a specified year.

A standard system of plan numbers should be used for plant location records as follows:

1. Digital file names consist of a distributor's three letter code followed by the appropriate series and with an extension of .utl for utility files, .lnd for land files, .i## (with ## being the last two digits in the year) for the infill files.
2. Drawing numbers within all plans are preceded with a four digit number (corporate registry number) to identify the distributor.
3. Township plans are identified by the applicable township-range-meridian numbers.

Township land files include such topographical details as highways, railways, roads, hydrographic, municipalities, or any other predominant surface feature as may be of benefit or necessary for the distributor to adequately operate its gas distribution system. The standard land base is the 1:20 000 topographical land base from AltaLis and copyrighted to the Government of Alberta.

Township files should also reference the hatched areas depicting the subdivision/area detail plans and the rural gas distributor's franchise area boundaries. (see Figure 8.1)

Township utility files may also include the location of other pipelines which are identified by the name of the owner/operator or the ERCB license number.

Subdivision/area detail land files show all associated legal plans registered with Alberta Registries, Land Titles, Department of Government Services and descriptive Certificates of Titles. The standard land base is the 1:20 000 cadastral land base from AltaLis and copyrighted to the Government of Alberta. (see Figure 8.2)

Rural gas franchise boundary plans are identified by the 700 series number. These plans are created and maintained by the Division.

8.4.2 *Relevant Documents*

Relevant documents consist of the following:

1. A listing of all the distributor's construction activity for the year. It coincides with the digital infill files and details customer names or construction projects, legal descriptions, subdivision drawing numbers, pipe sizes and service types.
2. A statement indicating the method of survey and that the pipe locations meet the Division's standard of survey accuracy.
3. A copy of any license applications made directly to the Board for construction of high-pressure pipelines (if applicable).

9. Operations and Maintenance

9.1. General

Good operation and maintenance practices are essential for the effective delivery of natural gas service to consumers, for the safety of consumers, utility employees and the general public, and to maximize the useful operating life of pipelines and plant. Each rural gas distributor has the option of expanding its operations and maintenance program to include such services as appliance installation and repair. However, each distributor is, as an absolute minimum, responsible for the safety of natural gas transportation and delivery and must include in its program sufficient practices, procedures and resources to cover:

- (a) Operation, inspection, maintenance and repair of all pipelines and plant it owns, between the point where it receives natural gas from a supplier and a point(s) where it delivers natural gas to its consumer(s).

All incidents resulting in damage to or gas leakage from a distributor's pipeline system must be filed online with the Division using the "Leak/Damage Report contained in the RGP Portal, an example of the format is shown in Appendix "C".

- (b) 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 Division's responsibility with respect to the public interest to ensure as far, as is reasonably possible that rural gas utilities 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 Division 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 the Division and the Federation of Alberta Gas Co-ops Ltd.

Where a distributor deletes or amends any part of this manual, the distributor must advise the Division in writing of the deletion or amendment that has been made. Although the Division 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.

9.3 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 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 the following areas as a minimum:

- (a) Properties of natural gas.
- (b) Emergency response.
- (c) Use and care of tools and equipment.
- (d) Operation, inspection, maintenance and repair of pipelines and plant.
- (e) Fundamentals of natural gas measurement.
- (f) Interpretation and use of plant records.
- (g) Use of records and reports.
- (h) Use of codes, standards and regulations.

9.4 Pipeline Location for Third Parties

A rural gas distributor must be prepared, on reasonable notice, to provide a pipeline location service upon request in cases where a person proposes to carry out a ground disturbance that may cause damage to its pipeline. This service necessitates three basic steps:

- (a) Obtaining and registering utility rights-of-way or other suitable instruments with the Land Titles Office in order that the existence of the distributor's pipeline may be evident from a review of land titles.
- (b) Preparing and filing accurate plant location records with the Division and/or with the Board (high pressure pipelines only) in order that the existence of the distributor's pipelines may be evident from a review of pipeline information systems (see Section 8.4).
- (c) Accurately locating and flagging its pipeline(s) and taking any additional steps which are necessary to ensure that the ground disturbance does not cause damage to the pipeline(s). These additional steps may include supervising the exposure of buried pipelines to ensure that the methods used to carry out the exposure will not cause damage to the pipeline. The need for a distributor to provide supervision reflects the distributor's expertise with buried gas pipelines compared to the more limited expertise that the person carrying out the ground disturbance may have.

Location and, if necessary, supervision services are an inherent responsibility of the distributor, and to maximize co-ordination 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.

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 ($^{\circ}\text{C}$) 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:

$$\begin{aligned} \text{DD} &= (\text{base temperature} - \text{mean temperature}) \\ &= (18^{\circ}\text{C} - 17^{\circ}\text{C}) = 1 \text{ degree-day} \end{aligned}$$

With a mean temperature of -40°C in mid-winter:

$$\begin{aligned} \text{DD} &= (\text{base temperature} - \text{mean temperature}) \\ &= [18^{\circ}\text{C} - (-40^{\circ}\text{C})] = 58 \text{ degree-days} \end{aligned}$$

The 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 hose 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 4.2.3.

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.

1. 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)	No. of Degree-days (DD)
July	7.0	57
August	4.6	47
September	17.6	368
October	23.2	550
November	40.6	800
December	48.0	1157
January	38.2	880
February	35.2	870
March	21.0	596
April	17.6	416
May	9.0	187
June	<u>6.6</u>	<u>135</u>
	268.6	6063

So, 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.

2. Assume:

- (a) Average heating value of gas: 1000 BTU/ft^3 or $1.055 \text{ GJ/1000 ft}^3$
- (b) Coldest day experienced: -40°C all day
- (c) Furnace cycling: *equal (50%) on-off*
- (d) Impact of other appliances: *minimal*

3. Convert natural gas energy consumption to volume:

Assumption: $1000 \text{ ft}^3 = 1.055 \text{ GJ}$

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

$$\text{e.g. } 268.6 \text{ (GJ)} \times \frac{1000}{1.055} \frac{(\text{ft}^3)}{\text{GJ}} = 254600 \text{ ft}^3$$

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

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

$$\text{e.g. } \frac{254600}{6063} \frac{(\text{ft}^3)}{\text{DD}} = 42 \frac{(\text{ft}^3)}{\text{DD}}$$

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

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

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

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

$$\begin{aligned} & (\text{Average volume per degree-day}) \\ & \times (\text{Degree-day per hour equivalent}) \\ & = \text{average consumption per hour on a } -40^{\circ}\text{C day} \end{aligned}$$

$$\text{e.g. } 42 \text{ ft}^3/\text{DD} \times 2.42 \text{ DD/hr} = 101.50 \text{ ft}^3/\text{hr}$$

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

Assumption: *furnace cycle 50% on & 50% off*

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

$$\text{e.g. } \frac{101.50 \text{ (ft}^3\text{)/hr}}{0.50} = 203.00 \text{ ft}^3/\text{hr}$$

Therefore, the estimated peak design load for this consumer would be rounded to 200 ft³/hr.

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 24 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 percent 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 percent 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.

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 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 defined control areas are:

- a. 30 metres from the centerline of internal subdivision roads and service roads.
- b. 40 metres from the center line 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 metres from the centerline of the roadway for municipal roads designated by the department as park roads.
- d. 100 metres from the centerline of any municipal roadway in areas of extreme adverse terrain conditions such as ravines and steep sidehills.

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.

The municipal authority would then either endorse the proposal or confirm to the distributor that the proposed pipeline route should be amended so as not to conflict with future road planning. Where the municipal authority is unable to endorse the proposal, it should provide the distributor with its required reasons for not doing so. Generally, these may include any of the following:

- a. 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.

- b. The need for an access control reserve buffer adjacent to the widened road allowance boundary in areas of existing or anticipated subdivisions.
- c. 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.

In advising the distributor of its reasons for recommending an amendment to the pipeline route, the municipal authority should also recommend 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 should be prepared to co-operate in establishing a third route which may be reasonably satisfactory to both parties. In such cases, the distributor should be prepared to bear the cost of pipeline relocation where the conflict identified by the municipal authority in its response to the distributor's submission does in fact occur in future road improvements.

Appendix "C"

Leak / Damage Report

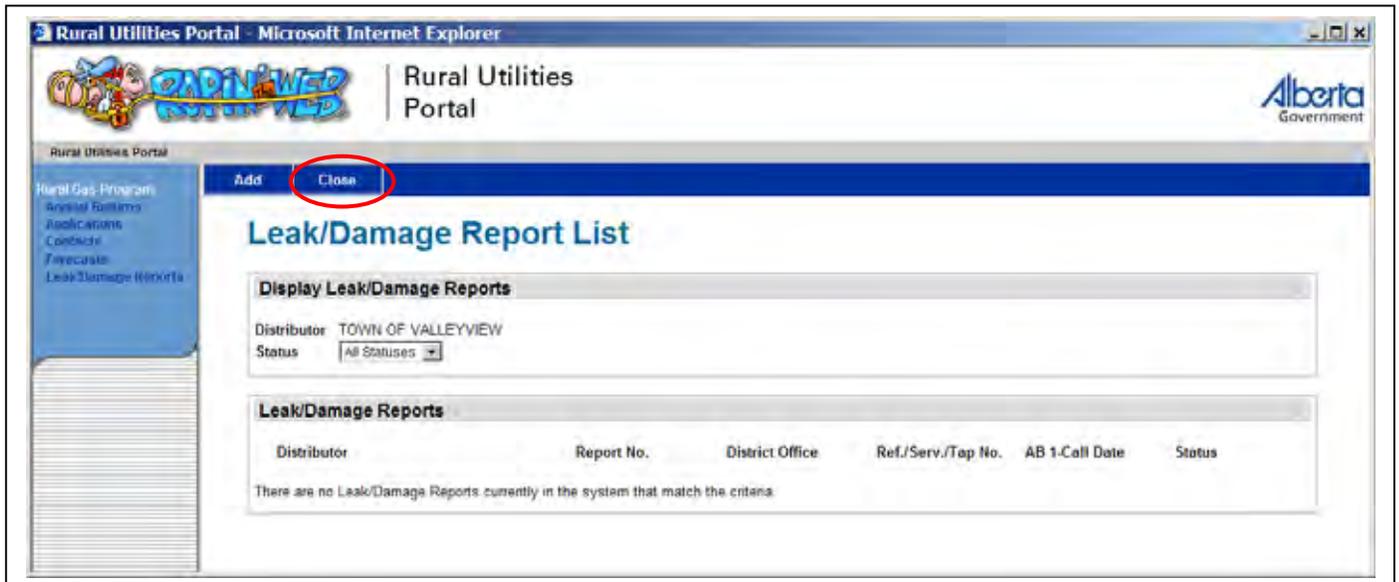
All incidents resulting in damage to or gas leakage from a natural gas distributor's pipeline system must be filed with the Division. This is a requirement in addition to any reporting required by the Energy Utilities Board or under any other provincial acts and regulations.

The report must be filed online through the Rural Utilities Portal using the Leak/Damage report templates.

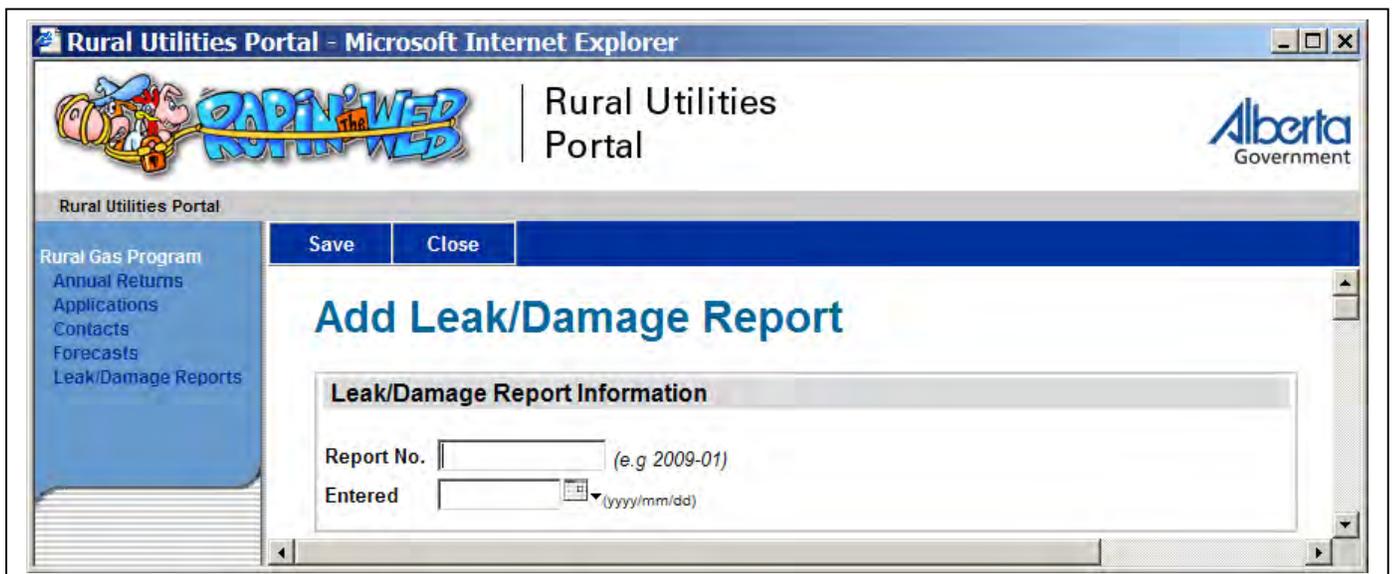
Tips on how to enter the data in the Rural Utilities Portal:

Use the Distributors username and Password to open the Rural Utilities Portal.

Entering the Leak/Damage menu will give you an option to see all your reports, if you click on "Add" the template where you enter the Leak/Damage information will open.



Always use the 4 digit year and two digit report number i.e. 2010-01 for the report number.



“District Office” should be annotated when the Distributor has more than one Office that responds to repairs.

The “AB 1-Call Date” is the date in which you received the on-call notification

The screenshot shows the 'Rural Utilities Portal' interface in Microsoft Internet Explorer. The page title is 'Rural Utilities Portal - Microsoft Internet Explorer'. The main content area is titled 'Rural Utilities Portal' and features a navigation menu on the left with options: 'Rural Gas Program', 'Annual Returns', 'Applications', 'Contacts', 'Forecasts', and 'Leak/Damage Reports'. The main form area has a 'Save' and 'Close' button at the top. The form fields include: 'Facility Owner' (with a dropdown menu showing '* TOWN OF VALLEYVIEW'), 'District Office' (text input), 'Ref./Serv./Tap No.' (text input), 'AB 1-Call Date' (text input with a calendar icon and a date format hint 'yyyy/mm/dd', circled in red), 'Site Location' section with 'Street Address', 'City', and 'Postal Code' (with an example 'e.g. T5T5T5'), 'Legal Land Description' with dropdowns for 'M:', 'R:', 'T:', 'S:', and 'Q:', 'Lot', 'Block', and 'Rural Subd'n' (text inputs), and 'Municipality/MD/ID/County' (text input).

The “Plant Damaged” box will only be annotated where there is damage by human intervention.

Proceed through the template box by box. Where there are pull-down menus select the appropriate option, if there is not an option that fits the scenario use the “Other” box to the right of that box (where that option exists) to identify or clarify the type of incident.

i.e. Natural Elements may be “Pipe Failure,, Mechanical or Fusion Joint Failure or possibly Lightning Hit.

If there is not a clear option just add your scenario in the “Other” box.

The screenshot shows the 'Rural Utilities Portal' interface in Microsoft Internet Explorer. The page title is 'Rural Utilities Portal - Microsoft Internet Explorer'. The main content area is titled 'Rural Utilities Portal' and features a navigation menu on the left with options: 'Rural Gas Program', 'Annual Returns', 'Applications', 'Contacts', 'Forecasts', and 'Leak/Damage Reports'. The main form area has a 'Save' and 'Close' button at the top. The form fields include: 'Area' (dropdown menu), 'Site' (dropdown menu), 'Plant Damaged' (dropdown menu, circled in red), 'Type of Incident' (dropdown menu), 'Activity' (dropdown menu), and two 'Other' text input fields.

For system failures situations a number of boxes (pertaining to hits/human intervention) will be not applicable (leave those boxes blank)

The screenshot shows a web browser window titled "Rural Utilities Portal - Microsoft Internet Explorer". The page header includes the "RAPINWEB" logo, the text "Rural Utilities Portal", and the "Alberta Government" logo. A navigation menu on the left lists "Rural Gas Program", "Annual Returns", "Applications", "Contacts", "Forecasts", and "Leak/Damage Reports". The main content area has a "Save" and "Close" button at the top. Below these are several input fields: "Damaged By" (a dropdown menu with an "Other" field next to it), "Company Name", "Contact", "Mailing Street Address", "Mailing City", "Mailing Postal Code" (with a hint "(e.g. T5T5T5)"), "Phone Number" (with a hint "(e.g. 7803334444)"), and "Working For".

The "Contact Authorized?" box will, in 99% of the cases, be a "No" or "N/A". The "Yes" option is only used where you have an abandoned line and permission is given to cut thru the line, or where a bigger steel line is crossing yours and you have given the contractor permission to squeeze off and remove a section of your line enabling their crews an easier alternative to cross under your line.

The screenshot shows the same web browser window as above, but with a different set of form fields. The "Save" and "Close" buttons are still present. The fields are: "Locates Requested?" (radio buttons for Yes, No, N/A), "Locates Done?" (radio buttons for Yes, No, N/A), "Locates Accurate?" (radio buttons for Yes, No, N/A), "Hand Exposed?" (radio buttons for Yes, No, N/A), "Locate Ticket No." (text input), "Date Located" (calendar icon and text input with a "(yyyy/mm/dd)" hint), "Facility Marked By" (dropdown menu), "Contact Auth'd?" (radio buttons for Yes, No, N/A, circled in red), and "Damage Preventable?" (radio buttons for Yes, No, N/A).

In the **“Pipe Classification”** box those options listed are for PE pipelines. If another type of pipe was hit please clarify pipe grade in the **“Other”** box to the right.

The screenshot shows the Rural Utilities Portal interface in Microsoft Internet Explorer. The page title is "Rural Utilities Portal - Microsoft Internet Explorer". The main header includes the "RAPIN' WEB" logo, "Rural Utilities Portal", and the "Alberta Government" logo. A sidebar on the left lists navigation options: "Rural Gas Program", "Annual Returns", "Applications", "Contacts", "Forecasts", and "Leak/Damage Reports". The main content area has "Save" and "Close" buttons. Below these are several form fields: "Line Size (O.D.)", "Pipe Material", "Pipe Manufacturer", "Classification" (highlighted with a red box), "Operating Pressure", and "Pipe Depth". Each of these fields has a corresponding "Other" text box to its right.

In the **“Repair Joint”** box if it is a mechanical repair joint and not a temporary repair, clarify why not - *i.e. CIL 219 resin*.

In the **“Description of Break”** box, if the incident is a third party hit, you would specify that in the **“Other”** box to the right (usual term is “severed”). If it is a lightning strike, the terms may be “melted” or “material blow-out”.

If the failure is a mechanical joint we would like to see the type of joint specified in the **“Other”** box - *i.e. Continental coupling – cracked nut, etc.*

If it is a fusion failure please specify if it was a workmanship or material failure *i.e cold face or separation in heat effected zone, etc.* in the **“Other”** box

“Time and Date of Break” when you have a release on your system that may have been identified by your wholesale/volume monitoring or line walk program – where applicable - please use your gas volume tracking program to estimate the date and time of any leaks.

The screenshot shows the Rural Utilities Portal interface in Microsoft Internet Explorer. The page title is "Rural Utilities Portal - Microsoft Internet Explorer". The main header includes the "RAPIN' WEB" logo, "Rural Utilities Portal", and the "Alberta Government" logo. A sidebar on the left lists navigation options: "Rural Gas Program", "Annual Returns", "Applications", "Contacts", "Forecasts", and "Leak/Damage Reports". The main content area has "Save" and "Close" buttons. Below these are several form fields: "Repair Joint Type", "Description of Break", "Time and Date of Line Break (Approx.)", "Time Incident Reported", and "Time/Date Emergency Crew Arrived". Each of these fields has a corresponding "Other" text box to its right. The "Time and Date of Line Break (Approx.)" field includes sub-fields for "Hour", "Minute", and "Date" (with a calendar icon and "(yyyy/mm/dd)" format), and a checkbox for "Unknown". The "Time Incident Reported" and "Time/Date Emergency Crew Arrived" fields also include sub-fields for "Hour", "Minute", and "Date" (with a calendar icon and "(yyyy/mm/dd)" format).

If your line walk program determined the leak, please note that in the **Comments Section**. Also add any information regarding third party hits that may help us deliver a need message to third parties that need to be reminded of the damage prevention process. If the main cause of a hit was due to locate issues, please give a summary of those issues.

Select **“Save”** to complete your report.

