



**CONSTRUCTION SPECIFICATION FOR
PIPELINE AND CONDUIT INSTALLATION BY PIPE BURSTING**

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463.01 SCOPE

This specification covers requirements for installation of existing or new gravity pipes (pipe culverts and stormsewers) using the trenchless technology known as pipe bursting.

463.02 REFERENCES

This specification refers to the following standards, specifications, or publications:

Ontario Provincial Standard Specifications, Construction

OPSS 401	Trenching, Backfilling, and Compacting
OPSS 404	Support Systems
OPSS 407	Maintenance Hole, Catch Basin, Ditch Inlet, and Valve Chamber Installation
OPSS 409	Closed-Circuit Television (CCTV) Inspection of Pipelines
OPSS 410	Pipe Sewer Installation in Open Cut
OPSS 421	Pipe Culvert Installation in Open Cut
OPSS 490	Site Preparation for Pipelines, Utilities, and Associated Structures
OPSS 491	Preservation, Protection, and Reconstruction of Existing Facilities
OPSS 492	Site Restoration Following Installation of Pipelines, Utilities and Associated Structures
OPSS 493	Temporary Potable Water Supply Services

OPSS 517 Dewatering
OPSS 539 Temporary Protection Systems

Ontario Provincial Standard Specifications, Material

OPSS 1801 Corrugated Steel Pipe (CSP) Products
OPSS 1802 Smooth Walled Steel Pipe
OPSS 1840 Non-Pressure Polyethylene (PE) Plastic Pipe Products
OPSS 1841 Non-Pressure Polyvinyl Chloride (PVC) Pipe Products
OPSS 1843 Non-Pressure Polypropylene (PP) Plastic Pipe Products

Ontario Ministry of Transportation Publications

MTO Forms:

PH-CC-701 Request to Proceed
PH-CC-702 Notice to Proceed

463.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

Annular Space means the space between the inside edge of the opening and the outside edge of the penetrating item or inserted pipe.

Design Engineer means the Engineer retained by the Contractor who produces the design and Working Drawings and other engineering documents required of the Contractor.

Design Checking Engineer means a separate Engineer from the design Engineer retained by the Contractor who checks the design and Working Drawings and other engineering documents prepared by the design Engineer required of the Contractor.

Fusion means connecting new gravity pipes lengths into a continuous length using elevated temperatures and pressure.

Launch Pit means an access excavation or existing access structure to an existing gravity pipe for the insertion of the pipe bursting head and new gravity pipes.

Pipe Bursting means the application of a pipe bursting head into the interior of and along the length of an existing gravity pipe to split or fracture it. This is so that the existing gravity pipe and surrounding material is opened up to a sufficient size to accommodate the insertion of a new gravity pipe in the cavity created, without leaving any significant voids around the new gravity pipe. Pipe bursting methods include static, pneumatic, and hydraulic. Pipe bursting is also known internationally as pipe cracking or pipe splitting.

Project Superintendent means an individual representing the Contractor that oversees the pipe bursting operation qualified to provide the services specified in the Contract Documents.

Pull means the installation of one continuous reach of new gravity pipes. Generally, a pull shall commence at a launch pit and terminate at a pull pit.

Pull Pit means an access excavation or existing access structure to an existing gravity pipe to receive the new gravity pipes or pipe bursting head or both.

Structure means a maintenance hole, valve chamber, or other such facility to access the new gravity pipes.

Trenchless Contractor means the subcontractor retained by the prime Contractor qualified to provide the services specified in the Contract Documents.

463.04 DESIGN AND SUBMISSION REQUIREMENTS

463.04.01 Submission Requirements

463.04.01.01 Qualifications

At least two weeks prior to construction, the names of the project Superintendent, and trenchless Contractor shall be submitted to the Contract Administrator.

463.04.01.01.01 Project Superintendent

The project Superintendent shall have a minimum of five (5) years experience on projects with similar scope and complexity.

During construction, the project Superintendent shall not be changed without written permission from the Contract Administrator. A proposal to change the project Superintendent shall be submitted at least one week prior to the actual change in project Superintendent.

463.04.01.01.02 Trenchless Contractor

The trenchless Contractor shall have a minimum of five (5) years experience on projects with similar scope and complexity.

463.04.01.02 Working Drawings

Three (3) sets of Working Drawings, and a Request to Proceed shall be submitted to the Contract Administrator 14 Days prior to the commencement of pipe bursting operations, or as specified in the Contract Documents. The pipe bursting operations shall not proceed until a Notice to Proceed has been received from the Contract Administrator.

All Working Drawings shall bear the seal and signature of the design Engineer and design checking Engineer.

Information and details shown on the Working Drawings shall include, but not limited to the following:

- a) A work plan outlining the schedule, procedures, launch pit and pull pit locations, and Working Drawings required to execute the work on the new gravity pipes, laterals, and structures.
- b) A list of personnel, including backup personnel, their qualifications, and experience.
- c) A traffic control plan.
- d) Safety plan, including the contracting company safety manual and emergency procedures.
- e) Drill path design, details of alignment and alignment control, and maximum curvature.
- f) Minimum depth of cover for pipe bursting appropriate for the highway type and pipe diameter, maximum excavation diameter, maximum annulus, alignment and grade tolerance.
- g) Detailed subsurface conditions along the proposed path or within the footprint of the pipe bursting equipment or pits.

- h) Design assumption and material data when materials other than those specified are proposed for use.
- i) Entry/exit pit details, as applicable.
- j) Jacking forces for installation of pipe, and for driving of pipe bursting equipment forward.
- k) When fusion joining is used, written record of current training showing that the operator has been fully trained in the use of the fusion equipment by an authorized representative of the fusion equipment manufacturer and the new gravity pipes manufacturer or, when applicable, certified by the Owner or Utility for which the work is being completed.
- l) When applicable, new gravity pipes bypass and temporary supply system plans, including installation, operation, and testing procedures, and a list of material and equipment to be used.
- m) Manufacturer's technical data containing complete information on new gravity pipes:
 - i. Material composition, physical properties, inside diameter, and wall thickness.
 - ii. Maximum tensile strength and corresponding maximum allowable pulling force.
 - iii. Transporting, unloading, storing, and handling recommendations.
 - iv. Repair.
 - v. Fusion times and temperatures.
 - vi. Minimum bend radius.
 - vii. Recommended restraint method in structure.
 - viii. New pipelines or conduits recovery requirements.
 - ix. Relaxation requirements.
- n) Contingency plans for the following potential conditions:
 - i. Unforeseen obstructions causing burst stoppage.
 - ii. Deviation from required alignment and grade.
 - iii. Extended service disruption.
 - iv. Damage to the existing service connections and the replacement of new gravity pipes' structural integrity and methods of repair.
 - v. Damage to other existing Utilities.
 - vi. Ground displacements (heave and settlement).
 - vii. Contaminated soil or water.
 - viii. Alignment passing through buried structures.

463.05 MATERIALS

463.05.01 Fittings

Fittings shall be suitable for and compatible with the type, class, pressure rating, and size of pipe with which they will be used.

463.05.02 Lubricant

Lubricant used to reduce friction, to maintain the annular space created by the pipe bursting head, and to allow the insertion of the new pipelines or conduits shall be non-toxic and biodegradable.

463.05.03 Pipe Materials

Pipe type, class, pressure rating, and size shall be as specified in the Contract Documents.

Gravity pipe type shall be consistent throughout the length of the gravity pipe as specified in the Contract Documents.

463.05.03.01 Concrete Pipe

Concrete pipe and joints shall be according to OPSS 1820.

463.05.03.02 Corrugated Steel Pipe (CSP) Products

Corrugated steel pipe products shall be according to OPSS 1801.

463.05.03.03 Polyvinyl (PVC) Pipe Products

Polyvinyl pipe products shall be according to OPSS 1841.

463.05.03.04 Polyethylene (PE) Pipe Products

Polyethylene pipe products shall be according to OPSS 1840.

463.05.03.05 Polypropylene (PP) Pipe Products

Polypropylene pipe products shall be according to OPSS 1843.

463.05.03.06 Smooth Walled Steel Pipe Products

Smooth walled steel pipe products shall be according to OPSS 1802.

463.05.04 Tracer Wire

Type and number of tracer wires used shall be as specified in the Contract Documents.

463.06 EQUIPMENT

463.06.01 Fusion Equipment

Fusion equipment, when used, shall be sized, and rated for the new gravity pipes. Fusion clamps shall be sized to clamp the new gravity pipes properly.

A weak link or breakaway connector shall be used to prevent excess pulling force from damaging the new gravity pipes. A load monitor on the pushing/pulling equipment shall be used to monitor, document, and report the pulling force applied.

463.06.02 Pipe Bursting Head

The pipe bursting head shall be according to the manufacturer's specifications for head sizes recommended for various new gravity pipes diameters and types, as well as parameters associated with maximum allowable upsize percentages.

All types of interchangeable bursting heads corresponding to the different types of existing gravity pipe shall always be available on site to mitigate delays and downtime, as specified in the Contract Documents.

The appropriate type of bursting head shall be used for each different type of existing gravity pipe, since the type of existing gravity pipe may vary within the section to be replaced by pipe bursting.

463.06.03 Pipe Bursting Power Source

The pipe bursting power source shall generate sufficient force to burst and compact the existing gravity pipe into the surrounding material.

463.06.04 Scaffolds

The coated areas of the structure, coming into contact with rollers, clamps, and other parts of the scaffolding and access facilities shall be protected using rubber or other material to prevent damage to the coating.

463.07 CONSTRUCTION

463.07.01 General

The new gravity pipe shall be installed following the alignment and grade of the existing gravity pipe and to the ovality specified in the Contract Documents.

The Contract Administrator shall be notified at least 48 hours prior to commencement of work.

463.07.02 Site Preparation

Site preparation shall be according to OPSS 490 and as specified herein.

The work site shall be graded or filled to provide a level working area for the pipe bursting equipment. No alterations beyond what is required for the pipe bursting operations shall be made. All activities shall be confined to designated work areas.

463.07.03 Preservation and Protection of Existing Facilities

Preservation and protection of existing facilities shall be according to OPSS 491.

When specified in the Contract Documents, an existing facility shall be exposed to verify its horizontal and vertical location. The number of exposures required to monitor work progress shall be as specified in the Contract Documents.

When specified in the Contract Documents, any above-grade facilities shall be supported as required.

463.07.04 Transporting, Unloading, Storing, and Handling Materials

Manufacturer's recommendations for transporting, unloading, storing, and handling of materials shall be followed.

Pipe rollers, skates or other protective devices as approved by the Owner shall be used to eliminate dragging of the new gravity pipe across the ground during pull-back operations, and to prevent any damage to the pipe on the edges of the pit. A sufficient number of rollers shall be used to prevent excess sagging of a pipe, and the rollers shall be of adequate size to fully support the weight of the new gravity pipe.

The gravity pipe shall not be dragged over the ground, and adequate rollers shall be used for both insertion and transportation of the pipe.

These gravity pipe guide rollers shall help minimize drag forces of pipe-pulling through horizontally drilled or bored holes.

The ends of the gravity pipe shall always stay capped while on site, to prevent the entry of contaminants into the pipe.

463.07.05 Trenching, Backfilling, and Compacting

Trenching, backfilling, and compacting for launch pits, pull pits, and other excavation locations shall be according to OPSS 401.

Launch pits and pull pits shall be sized to allow the use of the pipe bursting equipment and to allow the new gravity pipes to be installed such that the new gravity pipes manufacturer's recommendations for new gravity pipes bending radius are not exceeded.

463.07.06 Support Systems

Support systems shall be according to OPSS 404.

463.07.07 Dewatering

When required, flow diversion, unwatering/dewatering, shall be installed to fulfill the Contract requirements. Dewatering when required shall be according to OPSS 517.

The Environment Canada weather forecast shall be monitored prior to commencement of lining operations. Where the anticipated weather conditions are such that anticipated host pipe/box culvert flows may exceed the installed bypass pumping capacity or may cause potential site flooding, commencement of construction shall be delayed until favourable weather is forecast.

463.07.08 Temporary Protection Systems

The construction of temporary protection systems shall be according to OPSS 539.

Where the stability, safety, or function of an existing roadway, railway, watercourse, other works, or proposed works may be impaired due to the method of operation, protection shall be provided. Protection may include sheathing, shoring, and piling where necessary to prevent damage to such works or proposed works.

463.07.09 Temporary Potable Water Supply Services

When specified in the Contract Documents, temporary potable water supply services shall be according to OPSS 493.

463.07.10 New Gravity Pipes By-Pass

When specified in the Contract Documents, during the execution of the work, the flow within the existing gravity pipe shall be bypassed around the new gravity pipe being replaced and the continuity of service to each facility connected to the affected section of new gravity pipe shall be maintained. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows.

463.07.11 Preparation of Existing Gravity Pipes and Structures

Prior to pipe bursting, the inlets, outlets, and benching of existing structures shall be enlarged sufficiently for clearance of the pipe bursting head and the new gravity pipes. Enlargements shall be made neatly and be no greater than that required for their purpose. Size of the enlargements shall be sufficient to allow for restoration and sealing to the new gravity pipes.

Existing gravity pipe shall be cleared of obstructions (e.g., rocks and debris) or mechanical obstructions (e.g., repair sleeves, clamps, couplings, and intolerable deviations in grade or alignment) prior to pipe bursting.

463.07.12 New Gravity Pipes Joining

463.07.12.01 General

The new gravity pipes shall be joined according to the manufacturer's recommendations. The new gravity pipes shall be assembled and joined at the site to provide a leak-proof joint.

When space and the Contract Documents permit, the length of the new gravity pipes to be pulled shall be joined as one length prior to the commencement of the pulling operation.

When used, fusion shall be performed by technicians trained in the use of the fusion equipment.

Joints shall be capable of withstanding the loading of the installation process. All joints shall be subject to acceptance by the Contract Administrator prior to insertion.

The following provisions for the fusion process shall be followed:

- a) Each joint fusion shall be recorded and logged by an electronic monitoring device (e.g., data logger) affixed to the fusion machine.
- b) The joined pipeline or conduit, or both, shall be installed in a manner so as not to exceed the manufacturer's recommended bend radius.
- c) If the joined gravity pipe is installed by pulling in tension then the recommended safe pulling force in accordance with the manufacturer shall not be exceeded.
- d) Fusion machines shall meet the manufacturer's fusion specifications.
- e) The fusion technician shall be fully trained, certified, and licensed in the use of the fusion equipment by an authorized representative of the fusion equipment manufacturer and the new gravity pipes manufacturer.
- f) Qualifications shall be current as of the actual date of fusion performance on the project. Training records for qualified fusion technicians shall be made available to the Owner upon request.

463.07.12.02 Connection to New Gravity Pipes or Structures

New gravity pipes shall be allowed to recover from any induced stresses and strains before connection to new or existing gravity pipe or structures are made. New gravity pipes recovery time shall be according to the manufacturer's recommendations.

The new gravity pipes connection to the structure or to an existing gravity pipe shall be leak-proof.

463.07.13 New Gravity Pipes Installation

Installation procedures shall be according to the new gravity pipes manufacturer's guidelines. The new gravity pipes shall be protected from damage during the installation process.

Suitable guides shall be used to protect the new gravity pipes from damage at the insertion point and at any intermediate re-entry points.

The maximum axial/compression forces and bending moments shall not exceed tolerable limits of the new pipelines or conduits in order to avoid damaging the new pipelines or conduits or joints, or both.

Upon commencement of the bursting process, new gravity pipes insertion shall be continuous from the launch pit to the pull pit, except when approved by the Contract Administrator. A pushing machine may be used to assist insertion from the rear.

When specified in the Contract Documents, a weak link, breakaway connector, or load monitor shall be used to prevent excess pulling force from damaging the new pipelines or conduits.

463.07.14 Structures

When the new gravity pipes enter or exit an existing structure, the structure wall shall be restored as specified in the Contract Documents. Restoration shall securely locate and anchor the new gravity pipes in the wall and shall produce a leak-proof seal.

The existing structure's benching shall be restored according to the requirements of the new gravity pipes, any other incoming new gravity pipe and as specified in the Contract Documents.

When new structures are specified, they shall be installed according to OPSS 407.

463.07.15 Testing

Testing of the new gravity pipes joining and installation shall be according to OPSS 410 or as specified in the Contract Documents.

When specified in the Contract Documents, closed-circuit television (CCTV) inspection shall be completed on the new gravity pipes after installation.

463.07.16 Record Keeping

Fusion joint data shall be submitted as part of the As-Recorded information, as specified in the Contract Documents.

Verification record requirements of the alignment and grade of the installed new gravity pipes shall be as specified in the Contract Documents. A copy of the verification records shall be given to the Contract Administrator at the completion of the pipe bursting operations.

463.07.17 Closed-Circuit Television Inspection

CCTV inspection shall be according to OPSS 409.

463.07.18 Site Restoration

Site restoration shall be according to OPSS 492.

463.07.19 Environmental Protection and Contingency

Environmental protection requirements and mitigation measures shall be as specified in the Contract Documents.

463.07.20 Tracer Wire

Proper techniques shall be applied to safely pull all tracer wires during the bursting operation. Welding a hook to connect the tracer wires on to the bursting head shall be required.

463.07.21 Management of Excess Material

Management of excess material shall be according to the Contract Documents.

463.08 QUALITY ASSURANCE

463.08.01 Acceptance Criteria

Acceptance criteria for the new gravity pipes installation shall be as specified in the Contract Documents.

463.09 MEASUREMENT FOR PAYMENT

463.09.01 Actual Measurement

463.09.01.01 New Gravity Pipes Installation by Pipe Bursting

Measurement for a new gravity pipe installation by pipe bursting shall be by length in metres along the horizontal centreline of the new gravity pipe between connecting points or, if there is no connecting point, to the end of the new gravity pipes. When the connecting point is a structure, measurement for new gravity pipes installation shall be by length in metres to the centre of the structure.

463.09.02 Plan Quantity Measurements

When payment is by Plan Quantity, such measurement shall be based on the units shown in the clauses under Actual Measurement.

463.10 BASIS OF PAYMENT

**463.10.01 New Gravity Pipes Installation by Pipe Bursting, "Type, Diameter, and Use of New Pipelines" - Item
New Gravity Pipes Bypass - Item**

Payment at the Contract price for the above tender items shall be full compensation for all labour, Equipment, and Material to do the work.

The interchanging and use of multiple bursting heads shall be at no additional costs to the Owner.

All tasks related to locating, exposing, and disconnecting prior to bursting process shall be included in the unit price item for pipe bursting.

463.10.02 Closed-Circuit Television Inspection

When the Contract does not contain a separate tender item for CCTV inspection, the Contract price for the new pipelines or conduits Installation by pipe bursting item shall include full compensation for all labour, Equipment, and Material to do the work of CCTV inspection.