

Tech Note 7: Underground & Stainless Steel

TN.07

Underground refers to environments below ground level, and include inground buried, trenched and tunnel constructions. Our products are frequently installed inground with no special actions required beyond our recommended installation notes, however some situations to require additional consideration to ensure material and product suitability.

Applicable Products

- AusPress Stainless Drainage, diameters 50 to 315mm
- AusPress Stainless Press-Fit, diameters 54 to 168.3mm

Related Documents:

- Tech Note TN.01 Chlorides, Chlorine & Stainless Steel
- Tech Note TN.04 Insulation and Stainless Steel (Lagging)
- Tech Note TN.20 Brackets & Supports
- Tech Note TN.27 Expansion & Contraction

Product Suitability

In subterranean environments, direct contact with the pipework material can include (but not limited to):

- High water table waters and floodplains,
- Contaminated or reclaimed soils,
- Microbial inhabitants (ie MIC and/or SRB) – avoid iron oxidising bacteria too, prevalent in rusty/oil looking surface water, appearing brown on top of soils,
- High chlorine soils and sites near to bodies of salt water,
- Excessive expansion, contraction or restraint of movement by the concrete,
- Proximity to established or future plantings and the possibility of tree root egress.
- Soil movement; above ground weight loads including vehicles.
- Concrete and other construction materials.
- Influence of stray currents.

As a material, stainless steel is suitable for use inground, with grade 316 the preferred type installed.

Access to pipework after installation underground is often difficult. To permit serviceability and inspection access, diameters less than 75mm are not recommended.

A note regarding press-fit: Using press fittings underground is not recommended however, where installation above ground is not possible, protecting the pipework and joins is crucial. Press-fit shall not be used for gravity sewer, drainage or non-pressurised applications – see Tech Note TN.17.

Exposure to Soils

Confirming the soil type, stability and structure is important just as the material used for any backfill or compaction that may interact with the stainless steel material. Maintaining a dry, well drained environment is preferred for the best performance of stainless steel inground.

Site specific investigations including water and/or soil testing are recommended for each site by a NATA accredited laboratory. For example, the limitations of suitability for grade 316 stainless are where soil resistivity is between 2,000 - 5000ohm.cm; pH > 4.5; and Chlorides concentration is less than 1,000ppm.

Bedding & Backfill:

- Aggregate backfill: 6, 10 & 14mm diameter material is suitable, with these sizes allowing more air access to the surface of the drainage and free drainage of any ground water away.
- Clay soils or backfill: Not suitable from a heave and water retention perspective. Care for trenching through clay areas too as the trench can become a drain, and increase water in contact with the drainage which is not recommended.
- Sand backfill: Care for sourcing as beach sand is not suitable (from the salt levels). pH neutral washed sands can be used.

Heave & Movement:

Reactive soils require consideration to the potential movement between structure and pipework to ensure adequate movement and support is given to prevent damage. Consultation with a registered structural engineer is recommended as too soil tests to make an informed decision.

- Specialist fittings such as swivel, longitudinal expansion or combo joints installed at specific positions to accommodate the movement.
- Lagging as required by AS 2780 needs to be suitable for use with stainless steel (ie low-chloride content).
- Suspended clipping of drainage pipework is one method suitable with our drainage products with the drainage fixed to move with the building in a trench of uncompacted backfill material.
- Ensure ground water is directed away from the building line.

Vehicle and Surface Loads:

Minimum in-ground coverage depths for AusPress stainless drainage, depending on the surface finish (soil or reinforced concrete). Note the AS 3500.2 nominates depths that differ from our manufacturer dimensions. Best practice would be to observe the greater of both tables.

Trench Type 1 – Soil Only	110		160		200		250		315	
	Ped	Veh	Ped	Car	Ped	Car	Ped	Car	Ped	Car
Cover – Compressed Soil	230	360	320	460	340	490	440	610	410	570
Pipe Dia	110	110	160	160	200	200	250	250	315	315
Sand Bed	50	50	50	50	50	50	50	50	50	50

Trench Type 2 – Concrete Over	110		160		200		250		315	
	Ped	Car	Ped	Car	Ped	Car	Ped	Car	Ped	Car
Reinforced Conc 100 thk (min)*	100	100	100	100	100	100	100	100	100	100
Gravel Bed	75	75	75	75	75	75	75	75	75	75
Cover – Compressed Soil	50	50	50	50	50	50	50	50	50	50
Pipe Dia	110	110	160	160	200	200	250	250	315	315
Sand Bed	50	50	50	50	50	50	50	50	50	50

Notes for tables above:

- Installation to also refer to the full requirements of AS 3500.2.
- Separation from other services – 100mm min, 600mm from unprotected electrical, 500mm from electrical earth stake or electrodes.
- Depths of materials, structure and structural elements over the pipework shall be reviewed by a qualified engineer first to ensure no undue loads are transferred to pipework.
- These values are for 'dry' conditions where high water tables or high density soils >20kN/m3 (such as clay) shall seek further advice from AusPress.

Trenching:

Form trenches to ensure all trenching has fall to direct any captured groundwater away, rather than hold water that will soak the pipework externally. Keep the pipework dry externally is the aim.

Wrapping & Surface Protection

Pipework can be isolated from direct contact with soils by painting, wrapping and casing options with varying success and costs. Forming a continuous and impervious barrier (lagging or conduit) that extends a minimum of 75mm above finished ground level or past the area exposed to risk. Ensure condensation and moisture is not trapped between any protective layer and the stainless is critical, at installation and for the life of the installation.

Common options of surface protection include:

- Petrochemical wrap (such as Denso) is suitable with stainless steel when installed to the manufacturer instructions, including 55% overlap.
- Plastic sheath (such as loose, thin flexible PE gutter bag products) are not recommended with stainless steel as they can trap moisture and/or loose watertightness over time.
- Plastic closed cell polyethylene wrap (such as Polilag) is suitable with stainless steel when non-absorbent, compression resistant and installed to the manufacturer instructions, including 55% overlap.
- Conduit sleeving with an air gap between the sleeve and the stainless pipe where the materials are compatible and future access is possible (such as passing under a roadway).
- Sealed lagging where an external solid casing is used and the void filled with a compatible closed cell expandable foam to form a sealed insulated barrier to moisture is acceptable. Casing material is to be suitable for contact with soil and moisture and ends capped to seal the lagging assembly.
- Painting is not-preferred but can act as a barrier should sufficient coverage, thickness and adhesion to the stainless steel can be achieved and confirmed after installation.
- Cathodic protection is possible with grade 316 stainless but care is required to ensure the system is operated and maintained for ongoing protection.

Tunnel & Confined Spaces Suitability

Constrained environments can experience increased concentrations and exposure time with a range of considerations that include gas combinations, groundwater contact and a higher relative humidity. Please contact AusPress if products are to be installed in tunnels (bare mining, civil/traffic or concrete lined).

Exposure to Gasses

Whether part of the in-soil structure or atmospheric, some gases can be detrimental to stainless steel and the internal ring seal should also be considered for resistance. Common instances include former petrol stations, reclaimed sites or confined spaces such as tunnels.

Expansion/Contraction

Each socket of the drainage system allows for the small expected increases in thermal length. For example, stainless will expand ~1.0mm/m with 90°C water and a socket can allow 10mm of movement. Our Tech Note TN.27 discusses the expected thermal movement of various materials.

Freeze/Thaw Cold Climates

Refer to AS 3500.1 Clause 5.18. Minimum installation depth and 'dry' gravity pipework avoids the problems of frozen pipes expanding in cold climates. Ring seals are suitable for -20°C. P-Traps should not be used in cool rooms or where freezing is a possibility.

Concrete

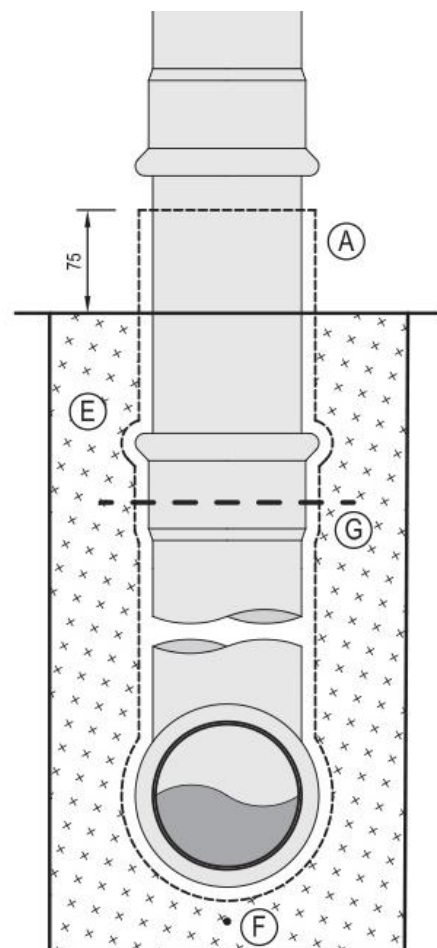
Wrapping the stainless surface to protect it from excessive chloride ion in the wet concrete is preferred but often grade 316 stainless is encased with little to no material effects (some external surface discolouration will occur).

This could be as simple as PVC tape or low-chloride foams (ie not standard closed cell polyethylene foam, but the low-chloride variety) for straight through penetrations of the concrete footing beam in each instance. Thrust blocks and other concrete masses should be separated from the stainless by a suitable surface protection method.

Where fully encased, wrapping each joint with layered Polylag to keep the joints free of debris and allow some movement is recommended noting stainless thermal movement is minimal at $\sim 1.0\text{mm/m}$ with 90°C water and requires consideration. Ideally joints are designed to not to be fully constrained.

General Design Considerations

- A. Forming a continuous and impervious barrier (lagging or conduit) that extends a minimum of 75mm above finished ground level or past the edge of the concrete.
- B. Ensure the barrier is suitable for use with the pipework material and application. Note for fire water pipelines, AS 2419.1 (fire hydrant) does not permit the use of loose poly sleeve as a barrier but requires a double wrapped layer of Denso (55% over-cover).
- C. The barrier is applied and installed in accordance with the manufacturer's instructions.
- D. Prevent trapping and the egress of moisture (including condensation) between the pipework external surface and the barrier material chosen. Prepare the surface to remove possible contaminants before 'trapping' with the barrier.
- E. Backfill the trench with pH neutral river sand with low chloride (this can be confirmed when ordering sand for a chemical batch analysis report from the supplier).
- F. Any trace wire be a minimum of 25mm clear of the pipework.
- G. Recommended warning tape be installed above the pipework in accordance with the relevant standard (eg AS 3500).



Press-fit shown as an example only.

It is noted that this is a generic installation method and each project shall be assessed individually to confirm suitability and effectiveness of the protection method.

Further Reading

- ASSDA have more information available for inground and stainless steel suitability available from their website www.assda.com.au.
- The VBA practice note "Drainage DR 02 Bedding Materials for Below Ground Sanitary Drains".