

SMART*lpg*

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SMART *lpg* BY NUPI INDUSTRIE ITALIANE

SMART *lpg* is a product range developed by **NUPI Group** for the conveyance of **LPG**.

NUPI Industrie Italiane has over 50 years experience in the design and manufacture of products using the latest generation of Polymeric materials culminating in the development of more than 20 product ranges for Water, Gas, Plumbing, Heating, Petroleum and Oilfield for industrial applications worldwide.

NUPI Industrie Italiane dedicates considerable investment in Research & Development activities, technological training and quality control.

Thanks to this technological commitment, NUPI Group is recognised as a leader amongst European companies for products manufactured with Polymeric materials.





1 • PRODUCT DESCRIPTION

1.1 WHAT IS THE SMARTlpg SYSTEM

The SMARTlpg system is a thermoplastic piping system reinforced with Polyester fibres suitable for the conveyance of LPG.

It is non hydroscopic, biocompatible and 100% recyclable.

The quality of the materials used and the strict quality controls guarantee to the SMARTlpg system a reliability of more than 50 years and a product warranty of 25 years.

1.2 FIELDS OF USE

The SMARTlpg system is used in the following applications:

- Underground installations for the conveyance of automotive LPG from tank to dispenser.

It is suitable for the following installations:

- Suction
- Product
- Filling
- Vent
- Vapour recovery

Thanks to its inner Polyamide barrier liner, SMARTlpg piping is suitable for the conveyance of LPG.

The SMARTlpg system is also suitable for the transport of hydrocarbons in liquid form such as:

- Toluene
- Mineral oils
- Vegetable oils
- Gasoline
- Diesel

For more information on other types of fluid, please contact NUPI Industrie Italiane S.p.A. Technical Office.



1.3 PIPE

The SMARTlpg pipe has an inner layer made of a specific Polyamide resistant to LPG, an intermediate reinforcing layer of Polyester fibre of closed frame construction and an external layer made of PE100RC (rock-pipe) that is resistant to crack and point loading.

The construction and design characteristics of the pipe guarantee the following performance:

- PN35 bars (508 psi)
- Bursting pressure > 200 bars (2901 psi)
- Resistance to the transported fluid
- Durability of 25 years
- Flexibility
- Resistance to corrosion
- Limited head losses
- Resistance to abrasion

1.4 FITTINGS

The SMARTlpg fitting range includes steel fittings made of a terminating fitting and a crimping bushing.

Regulations exclude the use of buried fittings. The use of this type of fittings is only allowed inside sumps that can be inspected.

The fittings are manufactured from a special Chrome-Molibdene 4 alloy having a resilience to low working temperatures higher than 27 Joules.

Male threaded terminating fittings with the following thread types are available:

- BSPP and conical ogive with 60° gas tightness
- BSPT and conical ogive with 60° gas tightness
- NPT and conical ogive with 60° gas tightness

Threaded flanges are available for flanged connections (EN1092-1).

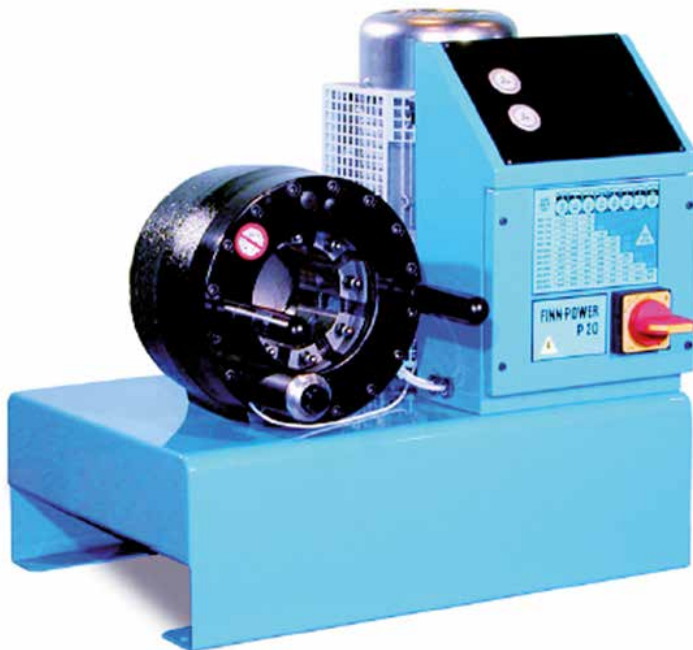


1.5 EQUIPMENT AND ACCESSORIES

For a correct installation of the SMARTlpg system, it is necessary to follow the specific instructions and use the specific equipment including:

- Pipe cutter
- Pipe bender
- Lubricant
- Go/No-Go gauge
- Caliper
- Crimping machine with specific crimping die set for fittings

The crimping machine is available in manual or electric model and shall have a crimping force of 137 tons.



Please refer to the assembly instructions and the user's manual of the crimping machine for a correct connection of pipe and fittings.

Different crimping machines shall be qualified before they can be used.



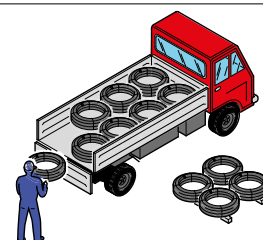
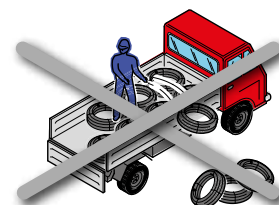
2 · TRANSPORT AND INSTALLATION OF SMART_{lpg} PIPES AND FITTINGS

2.1 PIPE LOADING AND UNLOADING

Loading, transport, unloading, stacking, storing and any other manoeuvre concerning plastic pipes and plastic fittings must be carried out with extreme care using suitable means according to the type and diameter of the item. All necessary safety measures shall be taken to avoid breakage, cracking or any other damage to pipes.

Any impact, bending and excessive overhang must therefore be avoided, as well as any contact with pointed or blunt objects.

If loading or unloading operations are performed manually, avoid grazing the pipes along any edge, on the platform of the transport vehicle, or on any sharp objects that might jeopardize the pipe surface.



2.2 PIPE STACKING

The pipes are supplied as follows:

- Coils on a plywood spool will be wrapped with a protective film
- Coils cut to length as per customer's request without spool will be protected by suitable packaging

The pipes shall always be stored in a secure location in order to preserve them from:

- Crushing
- Shock
- Other damage that could compromise their integrity

The packaging shall only be removed immediately prior to their use.



3 • UNDERGROUND INSTALLATIONS

3.1 PRELIMINARY OPERATIONS

Before commencing any installation, all installers shall be familiar with the installation procedures described in this manual and shall be trained by NUPI Industrie Italiane certified instructors.

Only installers duly trained and certified by NUPI Industrie Italiane S.p.A. are authorized to install the SMART/pg system.

The SMART/pg system is not covered by warranty if not installed by qualified staff.

- A two-worker crew is the minimum recommended for most average-size service stations.
- Ensure all necessary tools and equipment are at the construction site prior to commencing the installation of pipes and fittings.
- Establish a working schedule so that all phases of installation are carried out in a timely manner.

3.2 TRENCHING AND BACKFILLING

Proper construction of trenches is important to ensure that the SMART/pg system is installed under the best possible conditions. Trenches should be wide enough and deep enough to accommodate the piping and backfill material.

When using tamping equipment, prevent vibration from driving small stones into the pipe walls. The amount of compaction and the type of soil determine the soil modulus.

ATTENTION: Two pipes crossing over one another must be separated by a minimum of 2" (5 cm) of compacted backfill material to prevent point loading conditions or 1" (2.5 cm) of protective Styrofoam.

What is generally considered flexible piping is piping that changes shape when it encounters loads such as those transmitted by the soil to underground installations.

The designer and installer shall use the backfill material to limit the deformation of the pipes within an acceptable range.

The level of interaction between the pipe and the surrounding soil essentially depends on: burial depth, soil characteristics and backfill material, superficial loads and pipe resistance to deflection.



Generally, pipes and fittings should be installed at a minimum depth of **24" (60 cm)** according to standard EN14678-2. Installations requiring shallower or deeper depths may be necessary when designed in accordance with the specific project requirements e.g. when high frost load conditions are present.

All piping shall be separated by a distance of at least 4" (10 cm) from any other pipe as well as the trench wall as per standard EN14678-2. The material removed while excavating the trench **can be re-used as backfill material only if it fulfils the required criteria** (as outlined in chapter 3.3). The trench must be properly filled and compacted.

ATTENTION: The minimum distance of SMARTlpg pipes from the external perimeter of any building is 1 meter.

No pipe shall be installed in the trench for other applications, except for communication fairleads which shall be positioned at a distance of 30 cm at least.

The support given by the backfill material is proportional to its rigidity. For this reason, the backfill material in contact with the piping must be well compacted.

The rigidity of the soil above the pipe also has an important role in transmitting superficial loads to the pipe. Loads on the pipe are significantly reduced when the forces on the soil above and around the pipe are redistributed.

The more rigid the backfill above the pipe is, the less force is transmitted to the pipe.

Along with the characteristics of the backfill material of the trench, the material around the pipe must also be taken into consideration. Special attention must be given to soft clay and humid soils or sandy soils that can flake and make the walls of the trench unstable during excavation.

Flexible piping can be installed in similar circumstances without particular deformations if these conditions are respected. The main goal for installations with flexible piping is to avoid them being deflected. Pipe deflection can occur due to two principal reasons: the first is installation that reflects the care and techniques used when the pipes are installed and the second is the workload.



3.3 BACKFILL

The backfill material surrounding the pipes can be that which is already present or imported, such as gravel or granules or material excavated directly from the trench (filling material).

LPG piping shall be covered by a layer of at least 8" (20 cm) of clean sand without any stone or sharp object as per standard EN14678-2. The ideal size of the granules is 1/8" (3 mm) as per standard EN14678-2.

This material must guarantee resistance, rigidity, contact uniformity and stability to minimize pipe deflection due to the soil pressure.

We recommend wetting the layer of sand in contact with the pipe repeatedly to obtain the best compacting results possible.

Filling materials for an underground piping installation are usually identified as follows:

Groundwork: required only when the bottom of the trench does not provide a suitable base for the pipe bedding.

Bedding: it evens out the bottom of the trench to guarantee a uniform support base for the entire length of the pipe. When necessary, it also assures that slopes required for the pipe will be respected.

Primary backfill material: this material provides primary support against lateral pipe deflection. This area should cover at least 75% of the pipe diameter along the trench bedding.

Secondary backfill material: the material in this area basically distributes superficial loads and isolates the pipes from any possible effect derived from the final backfill material.

Final backfill material: the nature and quality of this material is less important than the other two regarding the effects on flexible pipes.

In any case, a rigid fill helps reduce the stress created by superficial loads.

To avoid possible impacts or loads concentrated on the pipes during and after filling the trench, the backfill material should not contain large stones, organic material or rubble.



3.4 BACKFILL CLASSIFICATION

When selecting backfill, pay close attention to the size of the granules, as well as to the form and distribution of the grains. Generally, material with large grains provides maximum rigidity and offers the best resistance.

Round grains tend to roll around easier compared to irregular grains that tend to lock into one another therefore providing better resistance to damage.

For example, gravel has a typical modulus of 1,000 psi (7 MPa) without being compacted, while sand requires light compaction (Proctor density of 85%) to achieve the same modulus. Refer to the following standards for further details:

- ASTM D3839
- AWWA C950
- CEN/TR 1295-3

Recommended types of backfill material are:

- Clean washed rough sand
- Pea gravel, 1/8" to 3/4" (3mm to 19mm) without any roughness

Mixed material tends to offer better characteristics than material with consistent characteristics. All backfill material must be dry and free from ice, snow or debris.

Along with the grain characteristics, density also provides an important effect on the rigidity of the underground installation. For example, the grains lock into each other in a dense soil. Movement in the soil is restrained and much energy is required, whereas in a mobile soil, movement causes rolling and sliding of the grains, which requires much less energy. Mobile soils cause more deflection for certain superficial loads respecting dense soil.

When a pipe is deflected, two effects can occur:

1. The pipe pushes against the material surrounding it and forces the soil to move. When this occurs, the soil resists it and prevents further deflection.
2. Vertical deflection causes the load transmitted to the pipe to be reduced and produces an "arch" effect in the soil.

Compaction is therefore a fundamental parameter. Compaction should be of a W level type (Well compacted material) or at least M level type (Moderately compacted material) according to the classification as per European standard CEN/TR 1295-3.

Backfill material has been grouped into five main classes. Backfill with low numbers corresponds to larger grains, which are more suitable for pipe burial.

Class 1 and 2 soils (GS1 and GS2 according to the European standard CEN/TR 1295-3) are granular and provide maximum support as shown by the high elasticity coefficient of the soil (E). The high permeability of materials belonging to class I and II eases trench drainage while making this material suitable in conditions where problems may occur due to water.



When a pipe is set under water level in the soil, granular backfill should be used (class 1 and 2). It is important that the grains are irregular to reduce eventual movement to a minimum.

Compaction class	Backfill material class			
	1	2	3+4	5
Low (N)	100	90	87	84
Moderate (M)	100	93	90	87
Good (W)	100	97	95	92

Table: relationship between compaction class, backfill material type and Proctor density

3.5 SPECIAL RECOMMENDATIONS FOR THE INSTALLATION

We recommend to follow the following guidelines for the installation of SMART/lpg piping:

- UK/lpg
- EN 14678
- NFPA 58
- EN 16125

These guidelines recommend in particular:

- To ensure that, if the pipe is installed in a casing pipe, no LPG can flow from the pump or the dispenser to areas where there is a risk of ignition.
- To place a ribbon identifying the type of pipe at least 12" (30 cm) above the pipe itself.
- To prevent any damage to the LPG pipe due to vibration or water hammer effect. To achieve this, the pipe shall be installed in order to avoid any contact with objects or structures that can cause surface abrasion.
- To avoid underground joints. If this type of joint is to be used, they shall be positioned so as to be inspected if necessary and shall be placed in special sumps.

3.6 RECOMMENDATIONS FOR SIZING

The following data shall be considered when selecting the correct piping DN:

- The maximum recommended speed is 2.2 m/s (0.7 ft/sec) - higher speeds can cause turbulence.
- The pressure drop calculated in the most critical conditions must be such as to ensure the proper flow of the fluid in the piping and dispenser.

Support for the selection of the correct piping size is provided by the flow calculation and simulation software supplied by NUPI Industrie Italiane that can be downloaded from the LITERATURE section of our website www.nupiindustriaitaliane.com.



4 • JOINING PROCEDURE OF THE SMART *lpg* SYSTEM

4.1 CRIMPING PROCEDURE

The following paragraph illustrates the procedure for the correct assembly of the SMART *lpg* system.

The crimping process must be performed using qualified equipment supplied by NUPI Industrie Italiane.

Prepare the equipment and check its correct maintenance/functioning.

1. Insert the ferrule over the pipe until it reaches the stop.
2. Lightly lubricate the tip of the insert to facilitate insertion (using liquid paraffin or other lubricating fluid compatible with LPG and steel).
3. Position the insert completely inside the pipe. Mark the insertion length of the insert.
4. Position the joint to be compressed inside the crimping machine ensuring that:
 - The wrench grip remains just outside the crimping zone.
 - The ferrule is completely in the stop of the wrench grip so as to prevent the bottom of the ferrule from overlapping the edge of the spacer present on the insert during crimping (see details below).



1.



3.



4.

NO



OK



DETAILS point 4.

The ferrule has reached a complete stop



5.



6.



7.



8.



10.

5. Move the crimping clamps close to each other without commencing the compression process by pressing the special closing button (Model P20X) or by using the hydraulic pump (Model P20HP).

6. Regulate the crimping dimension via the specific reference (graduated rotating handle for Model P20X, graduated rod for Model P20HP).

NB: the initial dimension for crimping regulation shall always be at least 1 mm larger than the nominal dimension of the crimped ferrule provided by the manufacturer (see table A). Achieving the final dimension shall be a gradual and monitored process, especially for the first crimping of the same DN to be carried out in subsequent steps.

7. Tighten the crimping clamps by means of the special button (Model P20X) or the hydraulic pump (Model P20HP).

8. **Use the go/no go gauge provided by the manufacturer to check the correct crimping tolerance.** Please note that a slight spring effect upon releasing the crimping clamp may occur and slightly widen the passage. Due to dimensional tolerances it might be necessary to slightly diminish the crimping diameter. Proper assessment must be made by means of the go/no-go gauge. Before removing the fitting from its location inside the crimping machine, slightly release the clamps and measure again using the go/no-go gauge. If re-crimping is necessary, ensure that the crimping marks on the ferrule coincide with the clamps.

9. Check again the correct crimping tolerance with the go/no-go gauge when the fitting is released from the machine.

10. Use the gauge to check the correct crimping diameter on the relief profile at the halfway point of the ferrule (see Table A in the following page).

CAUTION: The crimping process can be carried out only by qualified operators using appropriate equipment.



TABLE A – FERRULE CRIMPING DIMENSIONS

DN	Crimping diameter (mm)
20	30,7 (-0,3/+0,7)
25	39,5 (-0,3/+0,7)
32	46,6 (-0,3/+0,7)

IMPORTANT NOTES:

- The SMARTlpg system offers a variety of threaded fittings: ALWAYS PAIR UP PARTS WITH THE SAME TYPE OF THREAD. On the contrary, when the seal is NOT obtained through the ogive but via the thread, the best match is given by a conical male fitting and a cylindrical female fitting.
- The crimping machine shall always be used in a clean place. Always prevent dust or dirt from jeopardizing the correct closing of the crimping clamps.

ONLY INSTALLERS ADEQUATELY TRAINED BY NUPI INDUSTRIE ITALIANE S.p.A. ARE AUTHORIZED TO INSTALL THE SMARTLPG SYSTEM.

THE SMARTLPG SYSTEM IS APPROVED IF INSTALLED USING EQUIPMENT APPROVED BY NUPI INDUSTRIE ITALIANE S.p.A.

List of necessary equipment:

- 19TGSMCM
- 19TGSMCE
- 19TGSMCEXTRA
- 19TGSMC20DIESET
- 19TGSMC25DIESET
- 19TGSMC32DIESET
- 19TGSMAPNP20SS
- 19TGSMAPNP25SS
- 19TGSMAPNP32SS
- 19SCUT3





4.2 ADDITIONAL REQUIREMENTS FOR FITTINGS

Please refer to standard EN 14678-2 for fitting requirements.

FLANGES

Flanges shall comply with standard EN 1092-1.

GASKETS

Gaskets shall comply with standards EN 549 and EN ISO 11114-2 or equivalent.

SEALANTS

Sealants shall conform with standards EN 751-2 or EN 752-3 or equivalent.

Do not use hemp or minium (red lead).

All elements shall show adequate compatibility with LPG or its components.

4.3 PIPE BENDING

SMART/lpg piping can be bent only by means of appropriate supports and pipe benders and anyway for a minimum of 100 cm (39") bending radius.

It is also necessary to ensure that the pipe remains intact and does not show any sign of collapse in the bending area.

Thanks to its flexibility, the pipe can be bent up to 80°. However, some measures have to be taken to avoid that the pipe collapses, when performing this operation.

NOTE: *if the pipe collapses as a result of unsuitable bending, the piece of collapsed pipe shall be eliminated.*



5 • ELECTROSTATIC SAFETY FOR THE SYSTEM SMART *lpg*

The SMART *lpg* piping system has received the complete electrostatic safety certification by exceeding the many rigorous tests required by the Wolfson laboratory (UK). This certificate proves its absolute operating electrostatic safety. The complete report can be provided upon request.

As a rule of best practice, it is recommended to ground all metal components above ground.



5.1 CONCLUSIONS

As regards to the issue of electrostatic ignition hazards, the abovementioned evaluation demonstrated that:

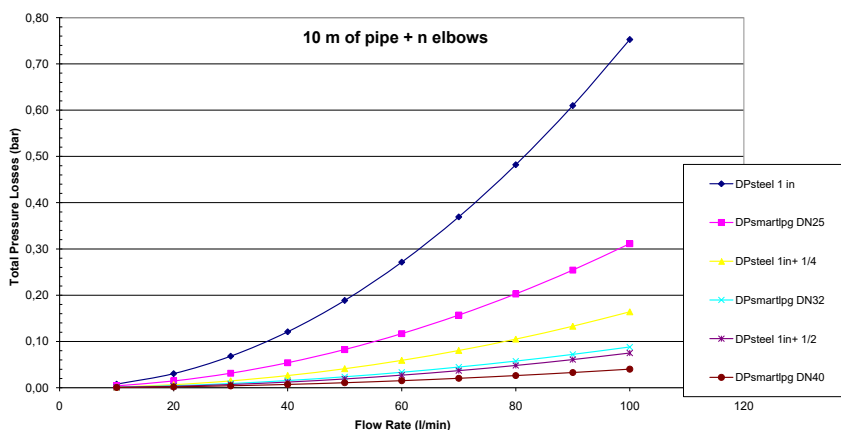
1. The SMART *lpg* system does not show any significant increase in the electrostatic ignition hazard as compared to conventional metal pipe work for the same type of installations.
2. Based on the typical fuel flow of gas station applications, there is no risk of hazardous brush discharges from the pipe due to fuel flow.
3. As a rule of best practice, it is recommended to earth all metal components such as valves, entry boot rings, etc.

5.2 ADVANTAGES

Here is a list of the main advantages of the SMART *lpg* system:

- Reduced installation costs
- Reduced head losses thanks to its inner smoothness
- Simple and quick installation
- Higher working pressure as compared to other systems
- Zero-joints continuous lines
- Flexibility
- Resistance to corrosion
- Resistance to abrasion
- The use of a pipe without conductive layer avoids the cumbersome task of carrying out regular checks of electrical continuity of the circuit as well as its constant grounding.

Total Pressure Losses (bar) comparison between Steel piping and SMARTLPG piping system





6 • SMART *lpg* PRESSURE TEST

All SMART *lpg* installations shall be tested through an approved pressure test prior to being put into service.

We recommend to use a properly calibrated pressure gauge for the test. We also recommend the use of a liquid and not a gas for pressures above 5 bars (72 psi).

Before starting any test it is good practice to inspect all the fittings to make sure that all crimping has been carried out correctly.

Before and during the test, make sure ALL necessary safety precautions are taken to protect:

- Operators who perform the test
- Operators nearby the place where the test is being performed
- People in general proximity to the area where the test is being performed

Piping shall be pressurized as described below: HYDRAULIC TEST followed by PNEUMATIC TEST.

6.1 **HYDRAULIC TEST AND PNEUMATIC TESTS**

All piping shall be tested at a pressure of at least 1.2 times the design pressure of the system (NFPA58) after isolating all the components that may be damaged by this pressure. Given the high pressures involved, we recommend to perform this test using a liquid medium (water).

After running the hydraulic test, all components previously isolated must be reassembled and the pneumatic test with inert gas at the minimum pressure of 5 bars (72 psi) shall be performed.

The pneumatic test shall be performed by respecting the following phases:

- Bring the pressure to 0.5 bars (7 psi) and check that all components are properly connected.
- Perform subsequent steps until the prescribed pressure is reached.



Both testing phases shall last at least 30 minutes and shall not show any pressure drop (in case of pneumatic test with inert gas, possible fluctuations must be justified by fluctuations in temperature).

Use soapy liquid to check the tightness of joints.

The test must be properly recorded on the form provided by NUPI Industrie Italiane or similar document showing the following basic information:

- Name of the company that installed the system
- Name and signature of the persons who carried out and supervised the tests
- Test date
- Name and address of the installation
- Design pressure of the system
- Pressure of the hydraulic test, duration and fluid used
- Pressure of the pneumatic test, duration and fluid used
- Test result
- Materials used and their PN

GUIDELINES FOR SYSTEM MAINTENANCE

The following guidelines shall be properly explained to the installer during the training:

- If a leak or fault is detected in any part of the system (by inspecting the sumps or through the leak monitoring system), the problem shall be resolved by the maintenance person immediately.
- If the piping system is damaged or there is a leak, shut down the system and contact the manufacturer's representative, installer or installation company.

The site manager or operator or any other person in charge should be advised accordingly.

WARNING

Ignoring or disabling any monitoring system alarm may cause future damage.



7 • WHAT IS LPG AND HOW TO HANDLE IT SAFELY

7.1 **SAFE HANDLING OF LPG**



WORLD LP GAS ASSOCIATION

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LPG is potentially hazardous from the point of production until it has been safely used and the combustion products have been properly disposed of. The term LPG describes a range of products which have much in common but also have their differences which affect the approach to safety.

Safety comes from understanding the behaviour of LPG and keeping it under control.

Every uncontrolled release is a hazardous event and should receive urgent attention. As pure LPG is odourless and invisible, a distinctive odour is usually added to warn of its presence. This allows even the smallest leak to be detected and receive the appropriate attention. However, as LPG is heavier than air an underground or low level leak might not be detected immediately.

Good appliance and installation standards are essential for safety.



7.1.1 GENERAL

The term LPG is an abbreviation for Liquefied Petroleum Gas and refers to hydrocarbon products, sometimes also described as light fractions. Butane and Propane are the predominant constituents of LPG.

In common with other forms of energy, LPG can be hazardous unless it is properly handled in a controlled manner.

LPG has its own special hazardous characteristics. LPG safety comes from understanding these characteristics and behaviour and from the exercise of control under both normal and abnormal conditions.

The behaviour of LPG is predictable and the technology for control is well understood. Good technical and safety expertise is to be found in the primary supply and marketing companies and in the major equipment manufacturers.

The application of this expertise becomes progressively more difficult as LPG is moved along the distribution chain and away from the direct control of the primary suppliers and marketers.

The hazards commonly associated with LPG are fire and explosion. Since uncontrolled releases of LPG can have serious consequences the prime objective of a LPG safety programme is to prevent uncontrolled loss of containment. However there are other hazards inherent in handling, distribution and use which are addressed in these Guidelines.

Butane, Propane and Butane/Propane mixtures are handled and/or distributed separately and for safety, one product should not be mistaken for the other.

The consumer receives LPG at the end of the distribution chain. In practice this can mean transportation over long distances and probably one or more transshipments. LPG safety must take into account hazards associated with the mode and duration of transport including the risk of traffic accidents and delays and their possible consequences.

Most LPG is used by combustion in an appliance which is itself part of a consumer installation. Adequate combustion air and ventilation are essential for safety. The products of LPG combustion, or product released as a result of leakage, should be vented to avoid a possible build-up of hazardous secondary products. The installer and the consumer have major roles in this aspect of LPG safety.

The vast range of LPG uses and of appliances as well as the variable scale of installations adds to the complexity of LPG safety.

Introduction of new applications, especially when accompanied by changes in distribution practices present new hazards and may call for the introduction of additional safety practices. The safety procedures in a marketer's bulk plant may not be adequate at an automotive re-fuelling station.



7.1.2 PHYSICAL PROPERTIES

LPG is produced in oil refining and the processing of natural gas liquids. Commercial, or fuel grade, LPG mainly consists of Butane and Propane with small amounts of lighter and heavier fractions, such as Ethane and Pentane.

Property	Propane	n-Butane
Chemical Formula	C ₃ H ₈	C ₄ H ₁₀
Boiling point at 101.3 kPa (°C)	-42.1	-0.5
Liquid density at 15 °C (kg/m ³)	506.0	583.0
Absolute vapour pressure at 40 °C (kPa)	1,510	375
Flash Point (°C)	-104	-60
Upper flammable limit (% vol. in air)	9.5	8.5
Lower flammable limit (% vol. in air)	2.3	1.9
Vol. vapour per vol. liquid	269	235
Relative vapour density (air = 1)	1.55	2.07
Coefficient of expansion (liquid) per 1°C	0.0032	0.0023
Minimum air for combustion (m ³ /m ³)	24	30
Kinematic Viscosity (centistokes) @ 20°C	0.20	0.30
Latent Heat of Vapourisation (kJ/kg) @ 20°C	352	368
Specific Heat (kJ/kg/°C) @ 20°C - liquid	2.554	2.361
Specific Heat (kJ/kg/°C) @ 20°C - vapour	1.047	1.495
Minimum ignition temperature (°C) in oxygen	470 - 575	380 - 550
Maximum Flame temperature (°C)	1980	1990
Octane number	>100	92
Specific Energy (gross) kJ/kg	49.83	49.40

It will be apparent from the above Table that there are significant differences in the physical properties of Butane and Propane. The values for LPG mixtures generally lie between these extremes depending on the ratio of Butane and Propane. However, quite small amounts of methane and ethane can have a significant effect on vapour pressure.



8 • FREQUENTLY ASKED QUESTIONS

■ **Is SMART/lpg piping certified?**

SMART/lpg piping is KIWA listed and is certified by WOLFSON Laboratory. It has also been evaluated and tested by the Technical Department of the Fire Brigade of the Italian Interior Ministry.

■ **What connection methods do you use to install SMART/lpg piping?**

SMART/lpg pipes are connected by means of high pressure crimped steel fittings.

■ **Are both BSP and NPT threaded fittings available for the SMART/lpg piping system?**

BSP, NPT and BSPP threaded fittings with 60 deg. conical ogive are available for the SMART/lpg system.

■ **Is the SMART/lpg piping system rigid or flexible?**

The SMARTFLEX piping system is classified semi-rigid.

■ **How do you become a SMART/lpg certified installer?**

The operator must undergo a Certified Installer training course prior to obtaining its Certified Installer credentials. The Certified Installer training is valid for a period of three years.

■ **What is the pipe bending radius?**

The suggested pipe bending radius is 15 times the nominal diameter DN (UK/lpg guideline).

■ **What is the warranty on this product?**

NUPI Industrie Italiane offers a 25 year warranty.

■ **What is the temperature range recommended for SMART/lpg?**

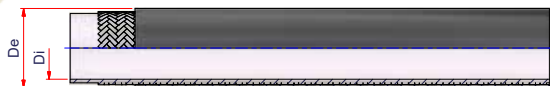
Between -20°C and +50°C.

■ **What is the minimum recommended burial depth for SMART/lpg pipes and fittings?**

24" (60 cm).

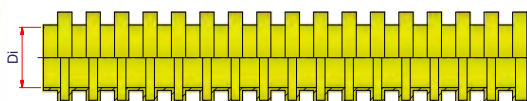


9 • THE SMART *lpg* RANGE



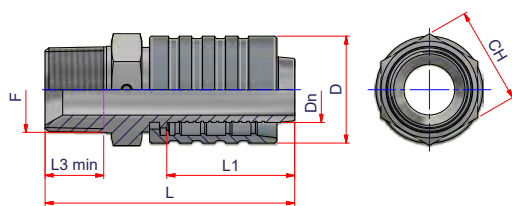
PIPE FOR THE TRANSPORT OF LPG GAS PN 35 bar

Code	ø	Package (m)	Di	De	Weight (kg/m)	Notes
19TGSMA20R500	20	500	20	26	0,23	Coils
19TGSMA25R400	25	400	25	32	0,39	Coils
19TGSMA32R250	32	250	32	40	0,49	Coils



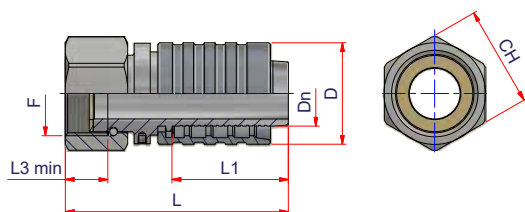
CORRUGATED PIPE

Code	ø	Package (m)	Di	Notes
19TGSCOR63	63	50	63	Stiffness 450 Newton



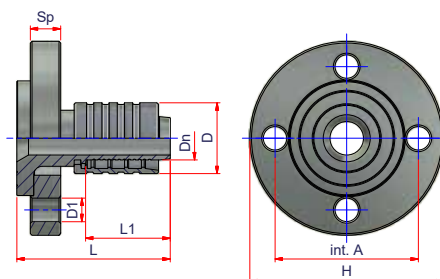
MALE THREADED TERMINATING FITTING ALLOY STEEL

Code	ø	Dn	F	L3 min	L1	L	D	CH	Notes
19TGSAM2034BSPPCM	20	20	3/4" BSPP	13,9	38	70	42	27	Parallel thread for coupling with conical head ISO228
19TGSAM2034BSPTCM	20	20	3/4" BSPT	14,5	38	72,8	42	27	Conical thread UNI EN10226
19TGSAM2034NPTCM	20	20	3/4" NPT	14,0	38	72,8	42	27	Conical thread
19TGSAM2534NPTCM	25	25	3/4" NPT	13,8	50	94,5	42	38	Conical thread
19TGSAM251BSPPCM	25	25	1" BSPP	16,8	50	94	42	38	Parallel thread for coupling with conical head ISO228
19TGSAM251BSPTCM	25	25	1" BSPT	16,8	50	98	42	38	Conical thread UNI EN10226
19TGSAM251NPTCM	25	25	1" NPT	17,4	50	98	42	38	Conical thread
19TGSAM32114BSPPCM	32	32	1"1/4 BSPP	19,0	57,7	98	50,5	50	Parallel thread for coupling with conical head ISO228
19TGSAM32114BSPTCM	32	32	1"1/4 BSPT	19,1	57,7	108	50,5	50	Conical thread UNI EN10226
19TGSAM32114NPTCM	32	32	1"1/4 NPT	18,0	57,7	108	50,5	50	Conical thread



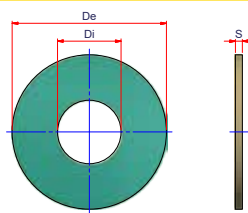
FEMALE SWIVEL ADAPTER

Code	ø	Dn	F	L3 min	L1	L	D	CH	Notes
19TGSAFSW2034BSPPCM	20	20	3/4" BSPP	12,5	38	83,5	34	32	Parallel thread for coupling with conical head ISO228
19TGSAFSW251BSPPCM	25	25	1" BSPP	12,5	50	96,5	42	38	Parallel thread for coupling with conical head ISO228
19TGSAFSW32114BSPPCM	32	32	1 1/4" BSPP	12,5	57,7	111	50,5	50	Parallel thread for coupling with conical head ISO228



KIT FLANGE (FLANGE + STUB END + GASKET)

Code	ø	Dn	L1	L	D	Sp	H	int. A	D1	N° fori	Notes
19TGFLAK20	20	20	38	78	42	18	105	75	14	4	Available soon
19TGFLAK25	25	25	50	91	42	18	115	85	14	4	
19TGFLAK32	32	32	57,7	103,5	50,5	20	140	100	18	4	



KLINGERSIL C 4430 GASKET

Code	ø	De	Di	S	Notes
00TGSGUA20	20	-	-	-	Available soon
00TGSGUA25	25	68	28	3	
00TGSGUA32	32	78	36	3	



BOLT KIT

Code

19TGSCFKIT



10 • THE SMART *lpg* TOOLS



CUTTER

Code	ø	Note
19SCUT3	20 ÷ 40	
19SLRCUT		Spare blade



SEALER

Code	Note
19TGSSF	50 cc



METAL CLEANER

Code	Note
19TGSMC	50 cc

PRODUCTIONS ON REQUEST AND PRODUCT CUSTOMIZATIONS

Code	Description
19TGSMC	<ul style="list-style-type: none"> • CUSTOMIZED PIPE CUTTING • PIPE TEST
19TGCUSTOMLENGTH	<ul style="list-style-type: none"> • CUSTOMIZED PIPE CUTTING • PACKAGING
19TGSPREASSCOMP	<ul style="list-style-type: none"> • CUSTOMIZED PIPE CUTTING • CRIMPING OF TWO FITTINGS • PRESSURE TEST AT 50 bar • PACKAGING
19TGSPREASS	<ul style="list-style-type: none"> • CUSTOMIZED PIPE CUTTING • CRIMPING OF TWO FITTINGS • PACKAGING



(A)

(B)

CRIMPING MACHINE



Code	Type	Description	Supplied components
19TGSMCM	(A) MANUAL	P20HP - 137 TON max OD 61 mm	Die sets DN25 and DN32 Go/no go gauge INCLUDED
19TGSMCE	(B) ELECTRIC	P20X - 137 TON max OD 61 mm	Die sets DN25 and DN32 Go/no go gauge INCLUDED

Delivery time = 90 days

ACCESSORIES AND SPARE PARTS

Code	Description	Notes
19TGSMCEXTRA	P32X - 200 TON max OD 84 mm	Die sets DN25 and DN32 Go/no go gauge INCLUDED
19TGSMC20DIESET	Die set for fitting DN20	
19TGSMC25DIESET	Die set for fitting DN25	
19TGSMC32DIESET	Die set for fitting DN32	
19TGSMAPNP20SS	Go/no go gauge for fitting DN20	Stainless Steel
19TGSMAPNP25SS	Go/no go gauge for fitting DN25	Stainless Steel
19TGSMAPNP32SS	Go/no go gauge for fitting DN32	Stainless Steel



**SMARTLPG PIPING SYSTEM
WARRANTY REQUEST FORM**

TO BE FILLED IN BY THE INSTALLER

Installer

Site

Name:

Site Owner:

Address:

Site name:

.....

Site address:

.....

Distributor:

Installation date:

Installation

The installed material has been delivered with delivery document No. _____ date _____

I/we declare that the following operations have been properly carried out:

- Field pressure test in compliance to the manufacturer prescriptions yes no
- Verification of the grounding of the metallic components yes no
- Registration and printing of the field pressure test yes no
- The fittings crimping connection has been duly carried out by following NUPI Industrie Italiane S.p.A. instructions by using a crimping machine approved by NUPI Industrie Italiane S.p.A. yes no

(crimping reports and pressure test reports must be submitted together with this form)

I/we declare that the information above is correct, that I/we are SMARTlpg qualified and trained installers (training date: by:) and that the installation described above has been carried out in compliance with the procedures for the installation of the SMARTlpg system.

Installer signature: Date:

I/we authorize the here registered personal data management and treatment in compliance with art.13 and 23 of the Law Decree 196/2003

Signature:

Verification of the installation before its closure and finalization:

Installation site manager: _____ Date: _____

Warranty becomes effective only after sending this form and relative annexed reports, by 30 days after the installation to: NUPI Industrie Italiane S.p.A. - Via Dell'Artigianato, 13 - 40023 - Castel Guelfo (BO) - ITALY

Registered Office and Headquarters
Via Stefano Ferrario 8 – Z.I. sud ovest
21052 Busto Arsizio (VA) Italy
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info@nupinet.com

Production and Operation
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info@nupinet.com

Production Facility
Via Colombarotto 58
40026 Imola (BO) Italy
Tel. 0331 344211 - fax 0542 670851
info@nupinet.com



FIELD PRESSURE TEST SMARTLPG SYSTEM

Site information

Name:	Address:
City:	Country:

LPG Installation data

Design Pressure:
Other components and relative PNs:
.....
.....
.....

Installer's data

Name:	Address:
City:	Country:

Test data

Hydraulic Test Pressure:	Hydraulic test duration:
Test fluid (water...):	Hydraulic test result (Positive/Negative):
Pneumatic pressure test:	Pneumatic test duration:
Test fluid (water...):	Pneumatic test result (Positive/Negative):

Person responsible for the test:	
(Name)	(Signature)

Supervisor of the test (if present):	
(Name)	(Signature)

DATE / /

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