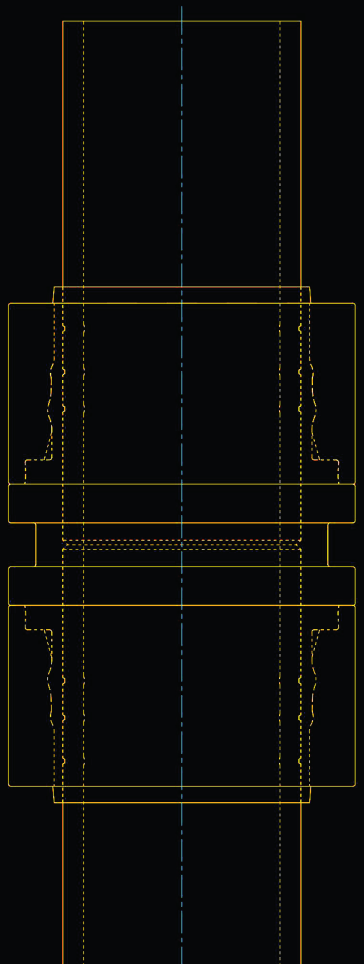
LiNX | AS

Connecting



Pipes

INTRODUCTION

LiNX | **AS** has developed the Next Generation of mechanically attached fittings: A cold-press pipe connecting solution that creates a permanent all-metal joint, replacing welding.

Inspired by the need and the potential in the market, we as a team from different parts of the globe have come together forming LiNX | **AS**.

Significant investment in Research and Development has produced a fully Tested and Certified initial product range of Fittings and Tooling.

GENERAL DESCRIPTION

LiNX | **AS** fittings use Elastic Circumferential Preload Technology to permanently join pipes without conventional welding or threading.

This all-metal joint is suited to situations where Cost, Safety and Scheduling are key drivers. The technology can handle pressures up to 1600 bar, and due to their rapid, low-cost installation, LiNX | **AS** fittings are also advantageous for lower pressure systems.

Insert the pipe in to the Fitting body, and use the Hydraulic tooling to advance two press rings axially over the fitting body. Radially compressing (Swaging) the fitting body on the OD of the pipe.

The pipe is compressed first elastically and then plastically during installation.

The body of the fitting has circumferential machined sealing rings which grip and seal the pipe OD, forming a gas tight and metal to metal seal.

A dedicated installation tool is also a part of the product that performs the cold work formation of the joint.

DEVELOPMENT HISTORY

The Idea was conceived by a valves manufacturer to provide an elegant engineered solution for the piping system that functions between two divert and control valves.

The need for an efficient and effective cold press pipe joint was clear, and the designed solution provides an opportunity for rapid and safe installation in hazardous gas environments and applications.

Meeting in Europe of like-minded industry experts confirmed project to take the idea forward.

Market research on business potential and competitive landscape, lead to agreement to invest in taking this forward. R&D project developed first drawings of initial concept.

Manufacturing of the first prototype.

Vigorous empirical testing and extensive use of computer modelling and stress analysis provided data that was returned and fed into the design iterations.

Development agenda, product range parameters and roll-out plan established.

Extensive testing of a range of sizes and materials, with complete ISO certification, developed to the ASME B31.3 standard.

Witnessed testing programme and certification secured.

APPLICATIONS FOR THE TECHNOLOGY

Oil, Gas & Petro Chemical

Chemical Processing

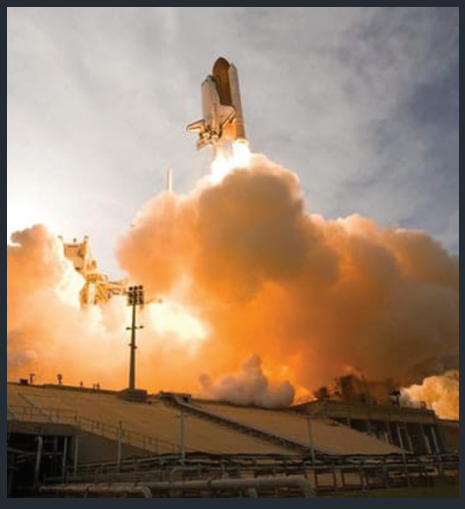
Marine & Shipping

Energy & Utilities

APPLICATIONS FOR THE TECHNOLOGY

Construction & Infrastructure

Aerospace



Pharma & Foods

ADVANTAGES OF LiNX | AS TECHNOLOGY

SIMPLICITY

- Quick and faultless installation
- 100% Metal to metal sealing (no elastomer needed)
- Simple assembly process (single piece fitting)
- Fit and forget reliability
- Reduced installation time

SAFETY

- Welding/Soldering eleminated meaning no 'hot works'
- No bonding or screws
- Only small installation space required
- Fire-Proof joint
- Boosting working efficiency
- No acid cleaning

COMPATIBILITY

- Compatible with both welded and seamless pipes
- Works on pipes with thin walls allowing the pipes to be correctly specified Imperial & Metric sizes
- Suitable for Carbon, Alloy & Stainless Steels

DURABILITY

- Improved corrosion resistance
- Higher pressure capacities
- Impervious to vibration and pulsation
- Means the pipe joints are no longer the weakest part of the system

COMPARISON BETWEEN WELDED JOINT & LiNX | AS FITTING

Welded Joint	LiNX | **AS** Fitting
All hydrocarbon and inflammable line needs to be isolation for hot works before welding	No hot works and no isolation required
Degreasing of the pipe outer (if any) needs to be done where the welding is required	Surface preparation with sand paper is sufficient
Cleaning the pipe inner by purging with inert or a neutralizing chemical may be required in certain piping areas	Not Required
Beveling of pipes need to done for a good welded joint	Not required
IBR certified,Tig/Mig welders are required to carry out the weld	No specialty person required to do a joint
Certain welding areas may require very high skilled 6G welder	Same fitting skill set is sufficient for any position of fitting
The work of the welder will require supervision from the project owner's side, as well as accessories, various types of gases,safety precautions, and a helper	Work supervision not required and the helper is optional
A spot weld first followed by seal weld needs to be performed for the best results	Just one sealing of fitting is sufficient
It is necessary to consider welding locations that could be modified or reworked. The weld needs to undergo radiographic qualification after welding.	Correct locking first time, every time removing doubt over integrity of the weld
Radiography is dangerous to humans and needs special care involving 2 persons and supervision	Not required
Power, fire alarm, and fire extinguisher requirements for the welding area Gas cylinder, potential danger	Hydraulic manual hand pump/Energy pack at 700 bar
Post welding the pipe needs to be stress relived in most cases involving 2 persons	Not required

CASE STUDY NEW BUILDING

A comparison was made between;
Fully Sleeve Welded (total 8,1 hour)
Welded Flange (total 9,7 hour)
LiNX | **AS** fitting (total 2,8 hour)

The exercise was completed using 2' pipe and involved 6 connections/joints, with an automated pipe bender used to make the bends.

Comparison of the 3 systems, in an identical pipe run, produced and installed in the workshop.

LiNX | **AS** fitting time saving : 65%
LiNX | **AS** fitting costs saving : 5%

In repair projects or projects outside the workshop the costs saving will be higher.

Labour Cost Includes:

Cost of qualified technician, supervisor, skilled and semi skilled workers to carry out jobs in piping system isolation, cutting, purging, degreasing and all preparation to perform a good weld, radiography and stress relieving.

Labour Cost Excludes:

Cost of training , certification and maintenance of certification for competency in skill for technicians

INSTALLATION BENEFITS:

	Highlights	Advantage
User Friendly	Lloyd's register approved	Tested and approved to meet all requirements of Lloyd's register
	Material choices suitable for wide range of applications	Customer can easily choose based on their application requirement needs
	Pipes range from ¼" to 2"	Fits perfectly with standard range of pipes
Project Oriented	Applicable to high pressure systems	One fitting can be used with other lower schedules
	No NDE Test requirements	Service can be started immediately after visual inspection
	Perfect installation on first clamping itself	Cost effective Process
Site Preferences	Adaptable to last minute change on site	Change can be for many reasons on site our fitting are adaptable to such changes with less disruption and cost
	Finalising the joint alignment can be done on site	Adaptable to minor misalignment on site
	Orientation of fitting installation not an issue	Changing the orientation of fitting do not cause any stress in the line

- Faster installation compared to alternative methods
- Better performance at lower cost
- 100% perfect and effective joint on single clamping-every time

OPERATION BENEFITS:

	Highlights	Advantage
Performance	Designed and tested to withstand harsh circumstances	Assured quality ensures safe use in service condition without and failure
	Service life longer than the pipe itself	Maintenance free during lifetime
Safety	Fire-Proof metal parts hold the joint even in fire	Suitable for use in pipelines carrying fuel and flammable fluids
	Uses no heat sources for joining so no fire or explosion hazard	Immediate return to service after repair

PRODUCT RANGE

SIZES:

Standard Range: ½” – 2” (21.3-60.3mm metric)
Custom Range*: 3" - 6" (13.7-168.3mm metric)
Special Range*: 1/4" - 3/8"

PIPE SCHEDULES:

Standard - 10 - 80
Special Order*– 120/160/XXS,

MATERIALS:

Standard – A29 4140 and 316L ,
On Request - 304 and 2205/2507.

Note: Alternative Stainless and Carbon Steels are available on Special Order*.Other specific materials for joints can be considered & developed against special requirement.

FITTING TYPES:

Standard - Straights , Repair , Reducer , Male NPT , Female NPT , Socket Weld, Butt Weld , Blind Cap

Welded Variants - Custom on Demand

Straight Fitting

Coupling Reducer

Male Adapter

Male NPT Adapter

Female Adapter

Female Npt Adapter

Socket Weld Adapter

Blind End Adapter

APPROVAL AND SAFETY TESTING

The tests are as per Lloyd's Register Specifications & ASTM F1387 Standards.

- Tightness Test
- Burst Test
- Pressure Pulsation Test
- Pull out Test
- Vibration Test
- Vibration + Pulsation Test

CERTIFICATION

Lloyd's Register

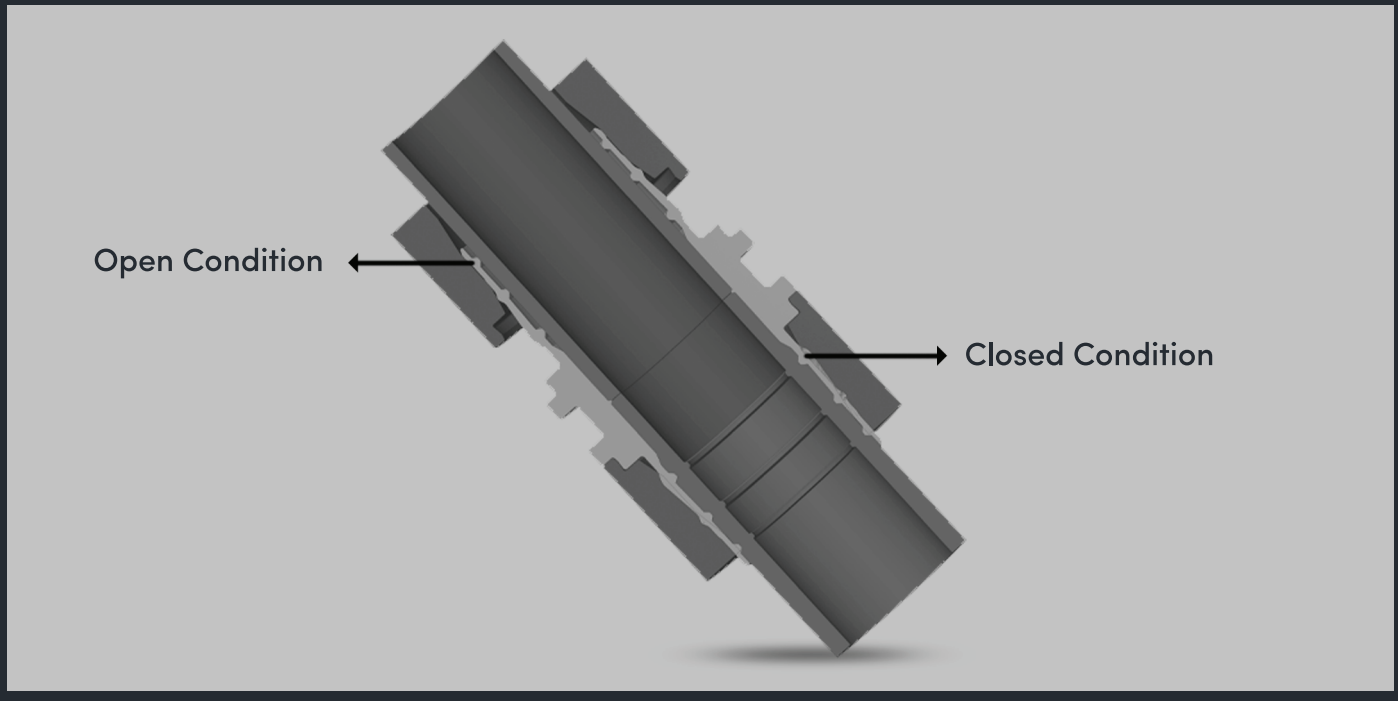
Cert No:
LR21242333TA

CERTIFIED ISO 9001:2015 COMPANY

Cert No:
44 100 18391815

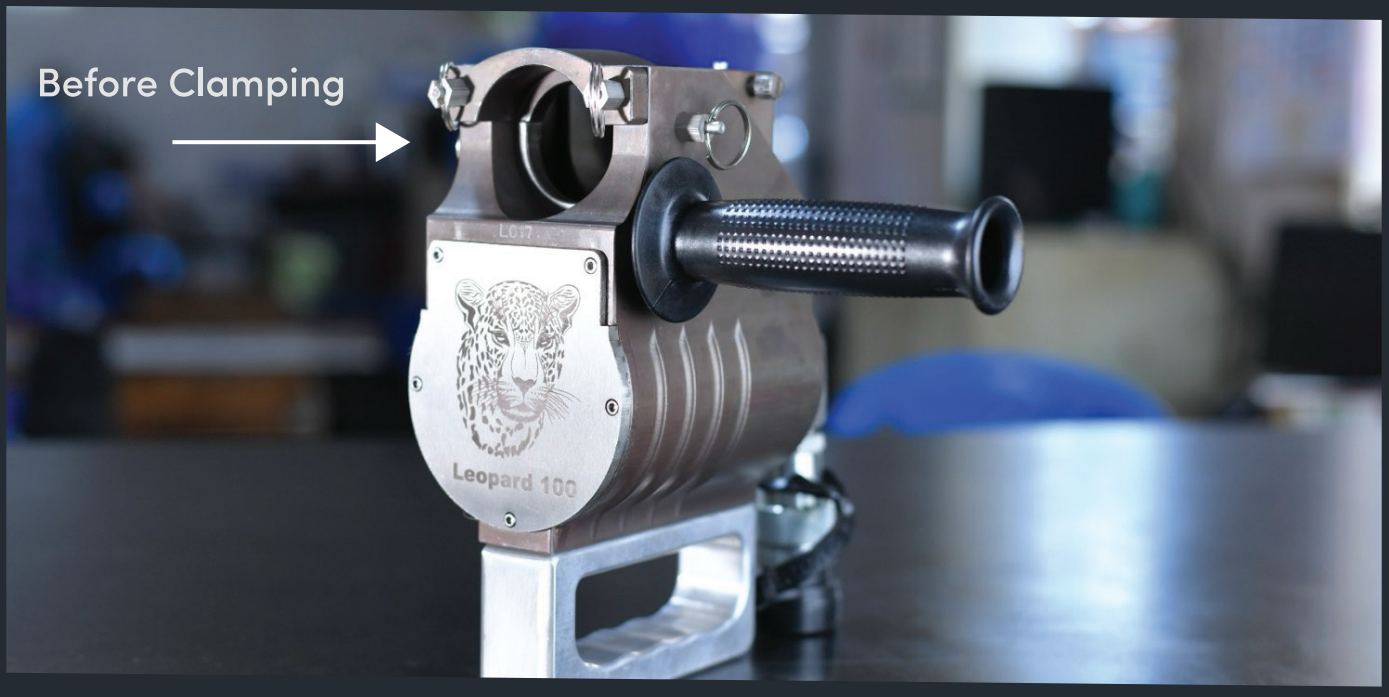
TEST FACILITIES

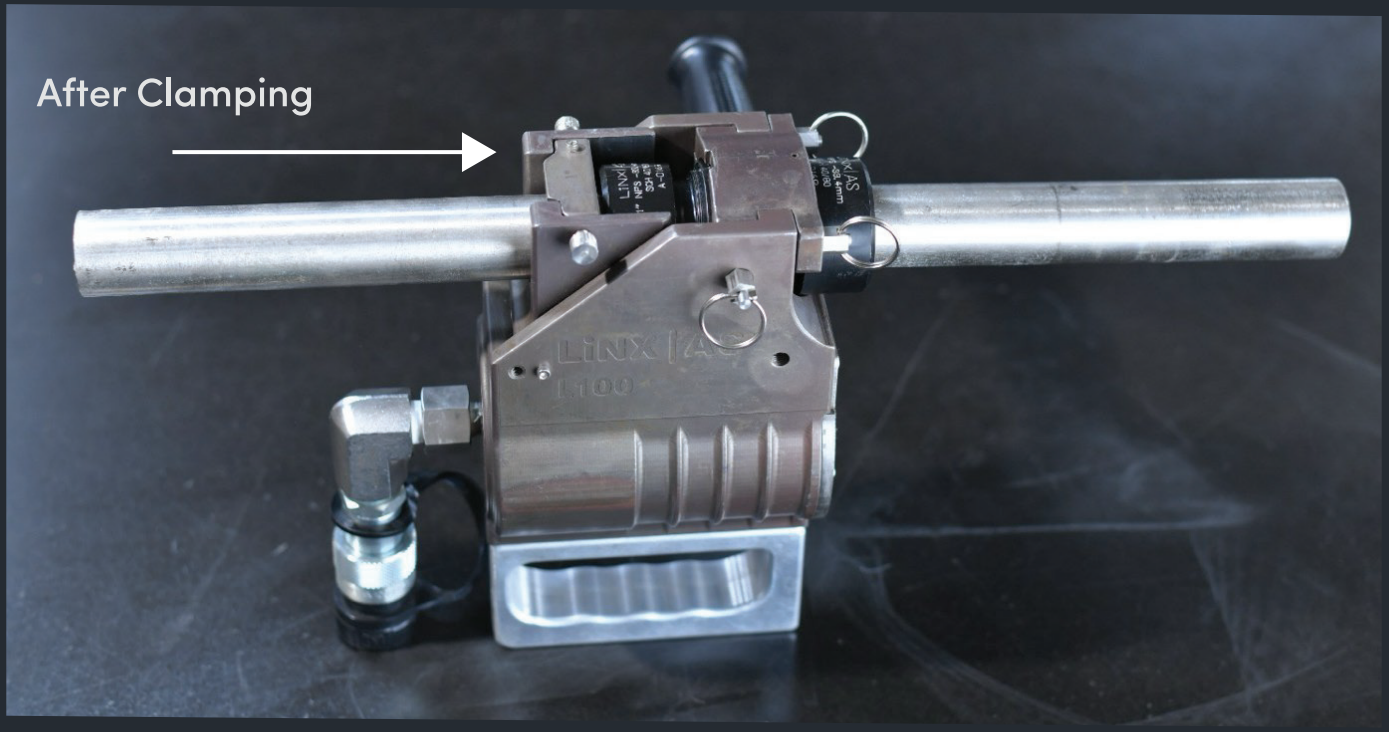
HOW LiNX | AS FITTINGS WORK



- The pipe ends should be cut as close to square as possible
- Pipe outer surface to be cleaned and prepped for a 360° seal
- Insert the pipe in to the Fitting body
- Using Hydraulic tooling, advance the two press rings axially over the fitting body
- Radially compressing (Swaging) the fitting body on the OD of the pipe
- LiNX | AS fittings tolerate out of square cuts up to ±5°
- The pipe is compressed first elastically and then plastically during installation
- The fitting body has circumferential machined sealing rings that grip onto and seal against the pipe OD, forming a gas tight and metal to metal seal
- LiNX | **AS** fittings form a joint that is stronger than the pipe

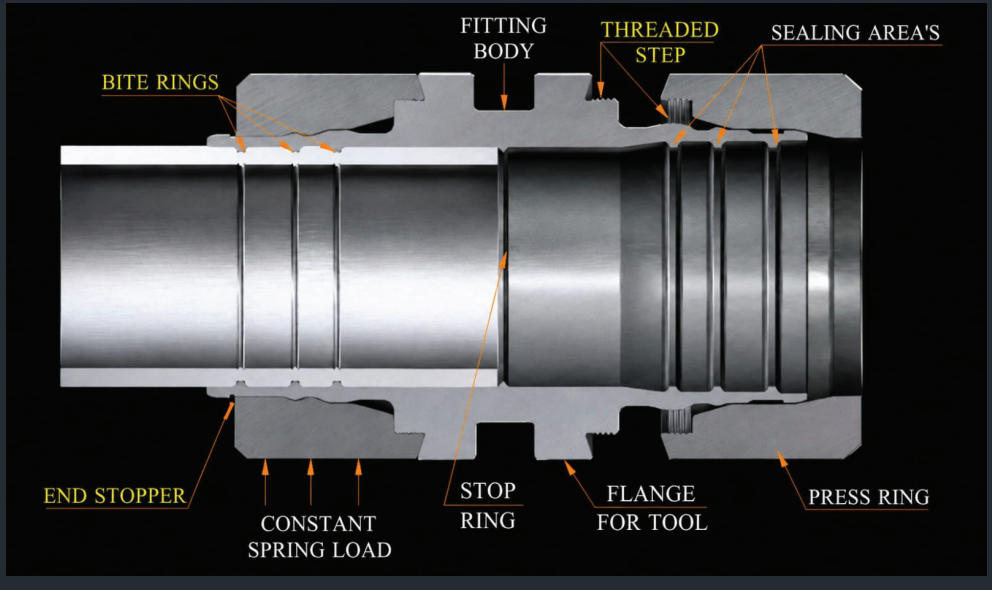
HOW LiNX | AS FITTINGS WORK





FUNCTIONALITY OF LiNX I AS FITTING

- Elastic Behavior crucial for creating a reliable seal and strong grip on pipe
- Axial Load moving the Bite Rings over body:
  - Causes it to slide over the body creating radial compression
  - Elastic deformation of the body to create the bite pressure
  - After full closure it becomes a plastic deformation that is permanent on the body
  - Body has slightly larger in Dia at the hump above Bite Ring on Body OD to cause radial elastic deformation on the Pipe
- Impact of Bite Rings on Pipe
  - The Bite rings wedge through the Pipe to create the seal lock
  - The wedge is created due to the elastic deformation of the bite ring
  - The differential hardness of the fitting compared to pipe, keeps fitting in plastic stage
- Locking Mechanism for LiNX | AS Fittings
  - Inverted Taper @ Flange OD & Press Ring ID with serration for a permanent lock
  - Retainer Ring at end of Body to hold the Press Ring to avoid Axial play



WORKING PRESSURE TABLE

ANSI Code for pipe pressures according to ASME/ANSI 31.3 are used to calculate pressure accordingly. Values were calculated according to B31.3, if pipe diameters and wall thicknesses are not included in table B31.3.

Pipe maximum diameter and pipe minimum wall thickness are basis for all calculations.

Imperial Table

Carbon Steel A29 4140

Pipe Size	Design Pressure* (P) in Bar			4 X Design Pressure*(P)in Bar Max.Burst Pressure (Test)		
Imperial	SCH.10	SCH.40	SCH.80			
1/2"	206	280	392	824	1120	1568
3/4"	160	224	319	640	896	1276
1"	150	210	294	600	840	1176
1-1/2"	115	154	221	460	616	884
2"	90	130	190	360	520	760

Stainless Steel 316L

Pipe Size	Design Pressure* (P) in Bar			4 X Design Pressure*(P)in Bar Max.Burst Pressure (Test)		
Imperial	SCH.10	SCH.40	SCH.80			
1/2"	170	231	326	680	924	1304
3/4"	134	189	266	536	756	1064
1"	121	175	245	484	700	980
1-1/2"	95	130	182	380	520	728
2"	58	100	150	232	400	600

Note: Pressure in bar. Pressure ratings are at 'normal' operating temperature ranges. Contact LiNX | **AS** Technical Support for recommendations on operating environments with extreme temperatures.

*Design pressure is maximum allowable working pressure according to IACS rules for Classification Societies.

LiNX | AS INSTALLATION INSTRUCTION

(also read How LiNX | AS Works from above)

LiNX | **AS** fittings come preassembled and so are handled by the end user as a single piece. It is therefore a simple and low skill job to complete a pipe connection.

After completing initial LiNX | **AS** training, a technician can connect pipes with consistent repeatable results by following a few basic rules.

The process largely relies on the pipes being cut square, the pipe surface exterior being free from corrosion and surface roughness or scratching, then the hydraulic press tool takes care of the rest.

It is important to ensure that the pipe to be connected is suitable for the LiNX | **AS** fitting, specifically in terms of the pipe dimensions being within tolerance and the hardness of the pipe.

Care should be taken to ensure that the correct LiNX | **AS** fitting is selected to match the pipe.

Contact your local distributor for installation training

1. PIPE SELECTION

The following items should be taken into account when selecting the pipes with LiNX | **AS** fittings.

- Pipe material
- Pipe wall thickness
- Pipe surface finishing
- Pipe hardness
- Pipe OD

Item		Unit	Requirement			Remarks
Pipe Material			Low carbon steel, Alloy steel, Austenitic stainless			Except cast iron pipeline
Pipe Wall Thickness		mm	Up to Schedule 80			
Pipe surface quality			Smooth surface with scratch depth not more than 0.1mm			
Pipe Hardness			Carbon Steel	Alloy Steel	Stainless Steel	Welded & Seamless steel pipe
		HB Brinell	170max	180max	200max	
		HRC Rockwell	7max	10max	15max	
Pipe OD	¼ ≤ ≤ 1½	inch	±0.4 mm			The sizes in diametric directions around circumference to be within the specified range
	D=2	inch	±0.8 mm			

2. PIPE HARDNESS

The hardness of the pipe material must always be less than the fitting hardness in order to assure the reliability of a LiNX | **AS** joint. Recommended maximum hardness for Carbon Steel pipe is 170HB. LiNX | **AS** fittings in Stainless Steel benefit from a proprietary hardening process to ensure a satisfactory margin.

3. PIPE PREPARATION

A potential source of leakage in piping systems are grooves on the pipe surface. Maintaining quality of pipe surfaces depends on the importance given to correct handling of pipes. Always remove surface rust or other contamination, check for pipe roundness and confirm outside diameter is within the recommended range for the fitting. Do not draw out the pipe from storage rack on the floor.

Only use of sharp pipe cutters or saws are recommended. Gradually step up the cutting speed of travel. Avoid faster cutting speed and always trim the areas you have cut.

4. PIPE WALL THICKNESS

The operating pressures for standard pipes relating to their wall thicknesses are calculated according to the "S-value" as stated in the ANSI Code B 31.3.

LiNX | **AS** fittings have been extensively tested with both minimum and maximum wall thicknesses up to the point of bursting the pipes.

Please contact or send a sample to LiNX | **AS** in case you need to use pipes with wall thickness different to industry standards and norms from the ones listed here.

TOOL SELECTION

TOOL ACCESSORIES REQUIRED FOR INSTALLATION

- Press Tool
- Tool Inserts
- Pipe Measurement Gauge
- Hydraulic hand pump / Energy pack at 700 bar
- 10ft Hydraulic Hose

TOOL MODELS

Model Name	Model ID	Tool Weight (KG)	Tool Kit Weight (Kg's)
Leopard	L100	9.75	17
Panther	P200	14.5	30

Kindly note that one Press tool can be used to install different sizes of fittings. Correct inserts should be used for each different size of fittings.

TOOL CLAMPING PRESSURE TABLE

	Tool Clamping Pressure Table (Carbon Steel)						Tool Clamping Pressure Table (Stainless Steel)					
Model ID	**Pipe Size**						**Pipe Size**					
Imperial	<1/2"	1/2"	3/4"	1"	1-1/2"	2"	<1/2"	1/2"	3/4"	1"	1-1/2"	2"
L100	-	450-500	450-500	450-500	-	-	-	400-450	400-450	400-450	-	-
P200	-	-	-	-	500-550	550-600	-	-	-	-	400-450	450-500

Note: Clamping Pressure value in Bar

TOOL INSERTS

LiNX | **AS** provides a comprehensive selection of tool inserts to ensure a correct fit and proper joint formation with the LiNX | **AS** hydraulic tool. Contact Technical Support to confirm insert specification for your fittings order.

PIPE MEASUREMENT GAUGE

The LiNX | **AS** measurement gauge enables the joint fitter to quickly confirm pipe dimensions, roundness and cut angle of the pipe is within the tolerance of +/- 5° as part of the installation process.

LiNX | AS

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