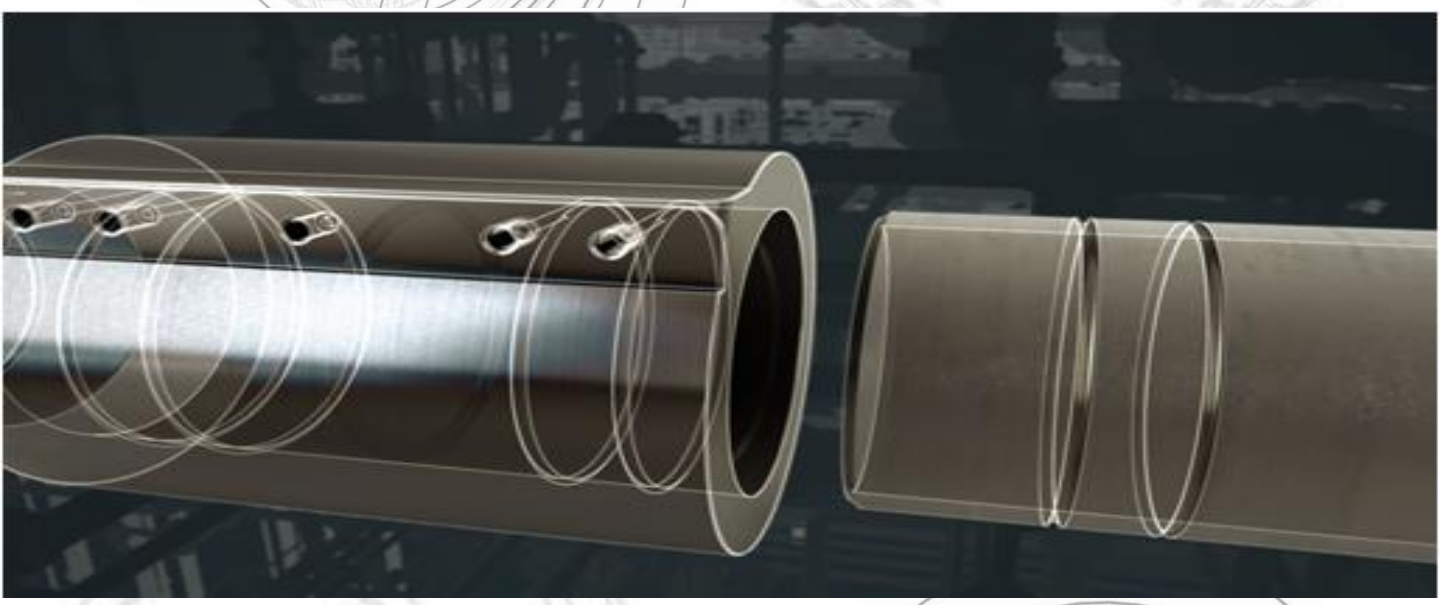
TECHNICAL
DESIGN DATA
COMBINING INNOVATION AND WORLD CLASS ENGINEERING



SNAP RING JOINT

SRJ

CONTENTS

IMPORTANT NOTICE

The technical, performance data, specifications, dimensions, and all other information published in this document supersede all previously published information.

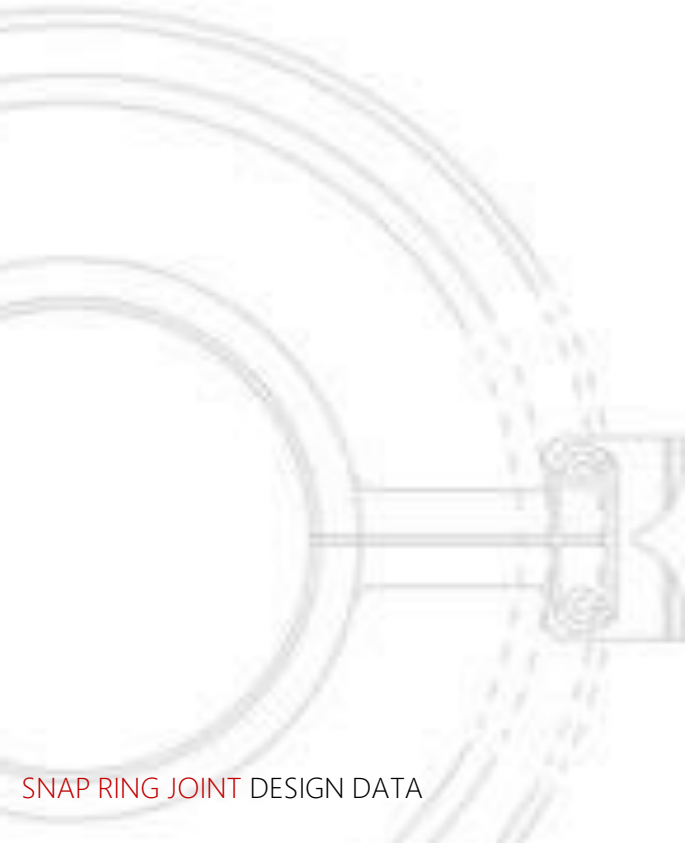
All data contained herein is subject to change without notice.

The information given in the following pages is intended as a general guide to the design and installation of the SRJ pipe coupling. It is not intended as a substitute for competent, professional advice, which should always be sought in the design of any piping system. Good piping practice should always prevail and recommended design pressures, temperatures, tolerances and loads should never be exceeded.

Special conditions often exist for which the information given here is not specifically suited and specialist engineering advice should be obtained.

While every effort has been made to ensure its accuracy, Snap Ring Joint Limited make no express or implied warranty of any kind in respect of the information contained in this technical design document or the materials referred to herein. Any person making use of the information contained here does so entirely at their own risk and assumes any and all liability resulting from such use.

The information contained within this section applies specifically to Snap Ring Joint Limited products only.



GLOSSARY OF TERMS

The following abbreviations are used in this document:

O&G	Oil and Gas
OD	Pipe outside diameter
NB	Nominal bore
A350 LF2	A general carbon steel usually supplied in a normalised and tempered or quenched condition.
HNBR	Hydrogenated Nitrile Butadiene Rubber
psi	Pounds per square inch
PCD	Pitch circle diameter

GLOSSARY OF STANDARDS

The following standards are used in this document:

API.5L	Specification for Line Pipe
ASME B31.1	Specification for Power Piping ASME Codes for Pressure Piping, B31
ASME B31.3	Specification for Process Piping ASME Codes for Pressure Piping, B31
ASME B31.4	Specification for Pipeline Transportation Systems for Liquids and Slurries ASME Codes for Pressure Piping, B31
ASME B31.8	Specification for Gas Transmission and Distribution Piping Systems ASME Codes for Pressure Piping, B31
ASME B31.9	Specification for Building Services Piping ASME Codes for Pressure Piping, B31
ASTM A694	Standard Specification for Carbon and Alloy Steel Forgings for Pipe Flanges, Fittings, Valves and Parts for High-Pressure Transmission Service
BS EN 166 :	Specifications for Personal Protection Equipment
BS EN 397:1995	Industrial safety helmets
EN10204 3.1	Metallic products. Types of inspection documents
IACS P2	Requirements concerning pipes and pressure vessels
ISO 19921:2005(E)	Ships and marine technology – Fire resistance of metallic pipe components with resilient and elastomeric seals - Test methods
ISO 19922:2005(E)	Ships and marine technology – Fire resistance of metallic pipe components with resilient and elastomeric seals – Requirements imposed on the test bench
NACE MR01-75	Petroleum and natural gas industries – Materials for use in H2S-containing environments in oil and gas production

1. PRODUCT OVERVIEW

The SRJ coupling is a weldless mechanical connector that has been designed to replace welding and/or other mechanical systems.

The design of the connector complies with the ASME piping/pipeline codes – B31.1, B31.3, B31.4, B31.8 and B31.9

The SRJ coupling comprises a single sleeve that spans the pipes being connected, which houses the couplings' sealing and gripping elements.

The couplings' grip is provided by retaining wires which locate into grooves in the body of the connector and corresponding grooves machined into the outside diameter of the pipe.

The sealing system comprises high integrity elastomeric seals which are currently available in HNBR (Nitrile) or Viton, depending upon the application. The HNBR seal is based upon casing sealing technology and is energised during coupling installation. The Viton seal is of a pressure energised lip seal design.

Please refer to section 9 for the general assembly.

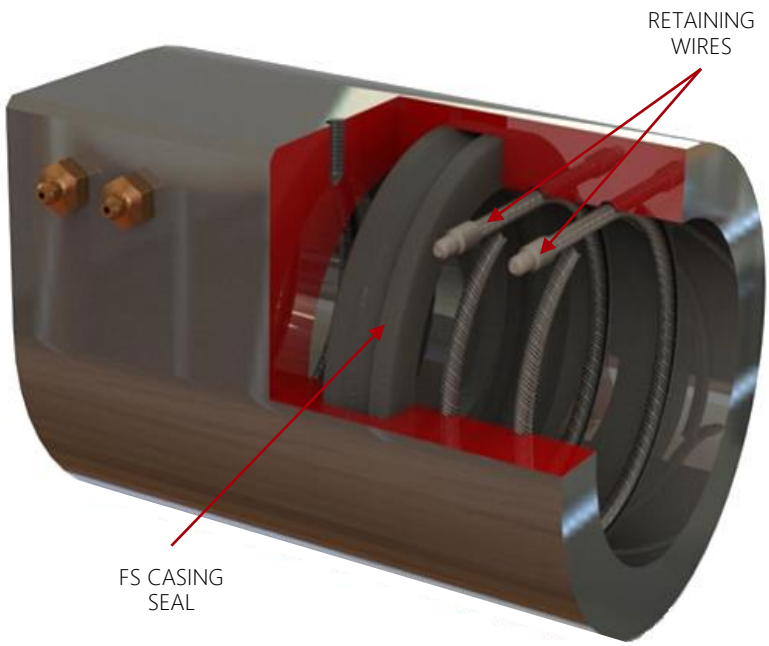
The selection of the seal is dependent upon the pipe content and the operating temperature. The current HNBR seal operating temperature is between -29 & 160 ^{O}C. The Viton seals operating temperatures is -20 and 200 ^{O}C.

The pipe in the area of the seals needs to be machined to ensure the seal performs as specified. The twin sealed version allows the coupling to be externally tested thus verifying joint integrity prior to pressuring the system going live. A metal sealed unit is currently under development

The SRJ coupling is unstressed (i.e. non-bolted) and relies on internal pipe pressure to load the retaining wires and energize the seals. This unique design allows the coupling to be compact and lightweight without the need to incorporate bolts for seal energisation.

The SRJ therefore offers many benefits over other pipe connection methods:

- Ability to withstand high internal pressures
- Speed of installation
- No welding required for installation
- No bolting required for installation
- Lightweight
- Compact
- Cold works only



2. DESIGN BASIS

The basic design of the connector complies with the ASME pressure piping – B31.1, B31.3. B31.4, B31.8 and B31.9 with additional load/application requirements being documented in the project information sheet contained within the Appendix of the accompanying Coupling Installation Procedures.

This data obtained from the customer ensures that the design not only meets the requirements of the codes but will be fit for its intended purpose.

The coupling is classified as an un-listed component in accordance with the specifications contained within ASME B31.3 and as such compliance to the code is as listed in paragraph 304.7.2

Code compliance is through proof testing.

Proof testing of a range of **connector's** representative of the size range being registered (up to 16" NB) has been conducted in accordance with the IACS P2 requirements, witnessed by Lloyds as part of their Type Approval program.

The connector materials and the level of allowable stress used in the design is based upon table A-1 of ASME B31.3. Allowable design stresses are used for the couplings main body but the retaining wires utilise a higher factor of safety with the allowable design stress at operating pressure being equal to 15% of the minimum ultimate shear strength of each of the retaining wires. (Note – the standard connector has 2 retaining wires fitted per side).

The design pressure used in the couplings design is based upon paragraph 304.1.2 of ASME B31.3 Straight Pipe under Internal Pressure

3. COUPLING DESIGN

The coupling, as previously stated is designed to comply with the applicable pipe design codes and has been designed so that it is not the weak link in the system as it is more than capable of withstanding internal pipe pressures up to pipe burst.

The depth of groove in the pipe is calculated to ensure that it does not impact on the pressure containing capability of the pipe or its safe operation.

When grooves are machined into the pipe as part of the assembly process, the pipe is then considered to be de-rated. Therefore, the pressure rating of the entire assembly should be considered rather than the point at which the grooves have been added but not the coupling. The pipe will never be subject to pressure within the grooves without the coupling. The coupling/pipe assembly is an 'Unlisted Component' in ASME B31.3 (see paragraph 304.7.2), that has been substantiated by a detailed stress analysis using finite elements. The design has also been substantiated by extensive experimental testing (in accordance with IACS P2).

The depth of groove in the pipe is determined by several factors:

1. The longitudinal stress in the pipe, under the groove does not exceed 20,000 psi (API.5L.grade B) at design pressure.
2. The pipe with the coupling installed is capable of withstanding the tensile pull test specified in the IACS P2 test regime. This states that the coupling must withstand a tensile load equal to the hydrostatic end force generated by the design pressure in addition to the coupling being pressurized to its design pressure.

The coupling sleeve spans the pipe ends being connected which provides stiffness to the connection point. This ensures that the bending capacity of the pipe is maintained whether the system is pressurized or not. Under bending, the moment is resisted by the 2 sets of retaining wires located on either side of the connection point which prevents excessive pipe movement in the area of the seals.

4. COUPLING INSTALLATION

The coupling is installed by trained and competent personnel and can be used for both new construction and pipe repairs. To prepare the pipes being connected standard clamshell type in situ machining tools are utilized which have the capability to cut the pipe, prepare the ends and to cut the retaining wire groves.

Section 10 of the accompanying Coupling Installation Procedures shows the complete pipe machining specification and provides a step by step guide to the products installation and removal.

5. PRODUCT TESTING

The coupling has successfully undergone a series of load/performance tests, in accordance with an industry recognised test program (IACS). The results of which have enabled Lloyd's to issue a Type Approval certificate covering the coupling's use on hydrocarbon systems in sizes up to 16". An overview of the tests undertaken is shown in section 11.

6. PRODUCT RANGE

The SRJ can also be supplied in the following variants:

- A blind flange, which is ideal when capping pipe work to facilitate a pressure test, thus avoiding the cost and time involved in welding a dome end to the pipe. If a pipe end has been fitted with a SRJ blind post-test the unit can be removed and the main pipe connection made by an SRJ coupling utilizing the same pipe end preparation.
- A Flange Transition unit, this product connects a bare pipe end to a pre flanged component, ideal for connecting to flanged piping components.
- A twin sealed unit which allows the connectors sealing integrity to be checked before the piping system is hydro tested.
- The SRJ system can also be incorporated into Reducers, Tees and Elbows.

7. CORROSION CONSIDERATIONS

The SRJ connector has been designed to ensure that any corrosion that occurs within the body of the connector will be minimal and will not impact the unit' s performance during its operational life.

The construction materials of the connector are selected to be compatible with the process fluid and pipe i.e. ASTM A694/A350 LF2 and controlled in accordance with NACE MR01-75 if sour service is required.

A simple low pressure environmental seal fitted at the end of the connector ensures the cavity between the pipes/coupling and retaining wire is protected from the environment and a facility is present to inject a suitable corrosion inhibitor.

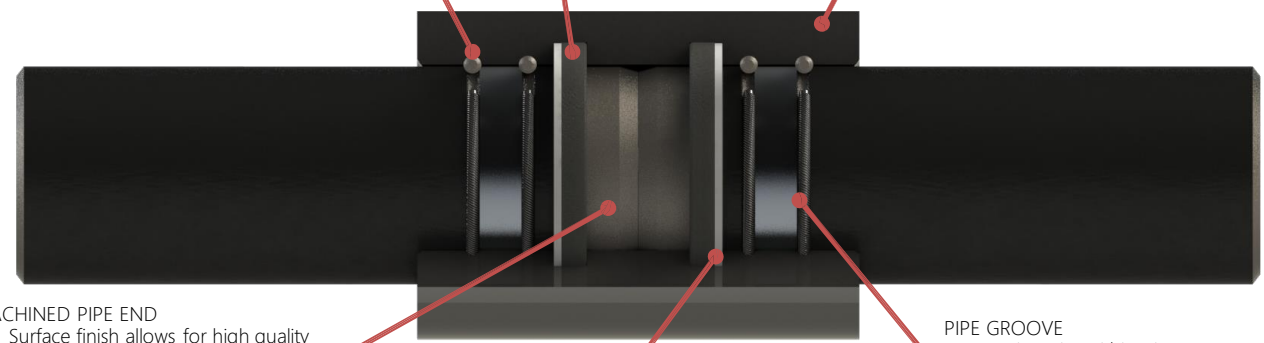
A small gap exists between the pipe ends so that the inner bore of the connector, up to the radial seals is process wetted, however, the pipe media in this area is not constantly replenished due to the size of the annulus and minimal pipe end gap. The seating stress of the seals is high enough to prevent media from passing beneath the seals, which mitigates corrosion in the area under the seals.

The external walls of the connector are coated with industry standard epoxy coatings to customer specifications.

8. DOCUMENTATION

The coupling as standard is supplied with a certificate of conformity, chemical and mechanical material certification to EN10204 3.1 along with a pressure test certificate covering the factory acceptance test. 3rd party verification of materials/testing can be supplied.

9. SRJ GENERAL ASSEMBLY



COUNTER WOUND HELICAL RETAINING WIRE
- Holds coupling in place
- Resists shear loading of pipe
- Flexibility for ease of insertion
- Threaded termination to assist insertion and extraction

PRESSURE ENERGISED LIP SEAL
- Creates seal with pipe
- Viton/HNBR material
- Suitable for a range of pipe media
- Available in various profiles and materials dependent on application

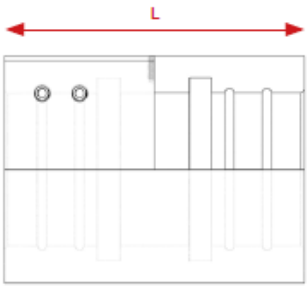
COUPLING BODY
- Houses the inner components and reinforces the radial strength of the pipe
- Designed to ASME B31.3 and the pipelines mechanical specifications
- Material chosen to match piping

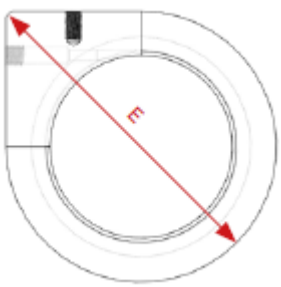
MACHINED PIPE END
- Surface finish allows for high quality seal
- End bevel for ease of insertion

ANTI-EXTRUSION BACKING RING
- Restricts lip seal from extruding due to high pressure

PIPE GROOVE
- Retains wire within pipe
- Depth calculated to guarantee joint remains below allowable stress for hoop, tensile and bearing loads

PIPE SIZE NB (inch)	LENGTH [L] (mm)	ENVELOPE [E] (mm)	WEIGHT (kg)
2.5	146	136	5.85
3	178	157	9.10
4	229	193	17.21
6	337	255	35.39
8	438	323	68.20
10	546	394	118.34
12	648	458	174.49
14	711	498	216.14
16	813	563	301.34

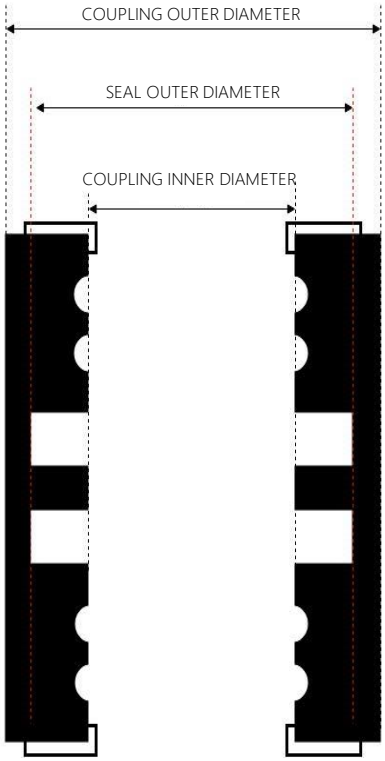




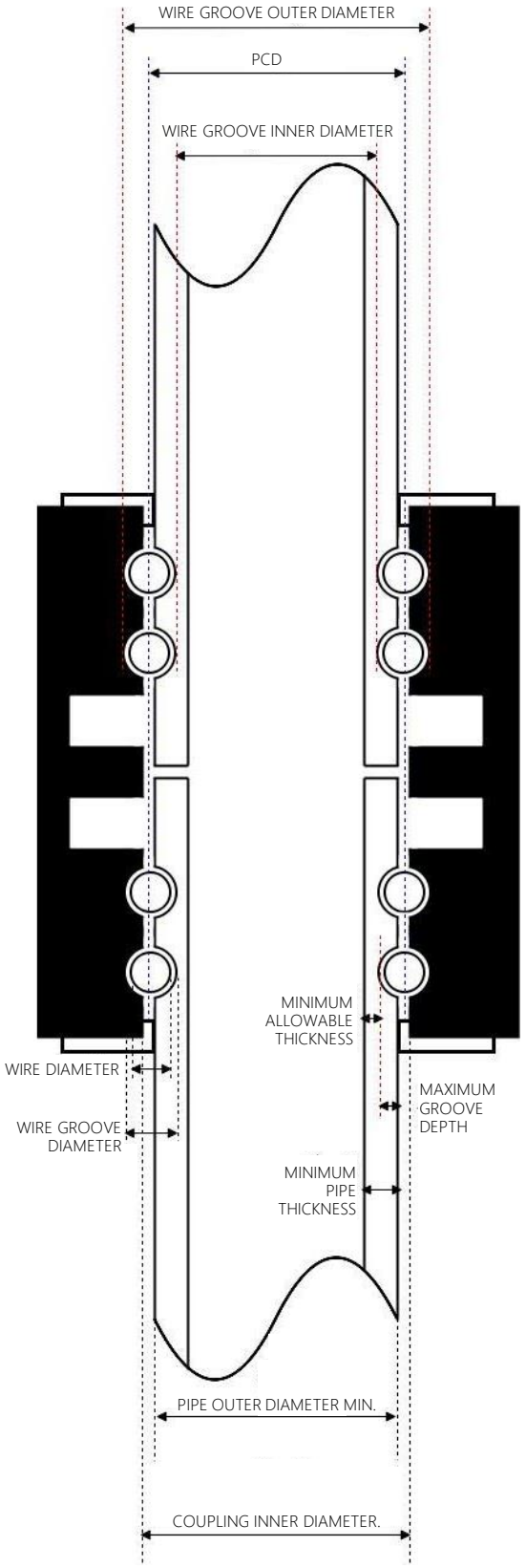
10. DESIGN METHOD

The coupling relies upon the integration of the SRJ within standard piping systems. Schedule 40 systems want to continue using schedule 40 pipe. Hence, the SRJ has been designed and tested to ensure it can be integrated seamlessly. The SRJ has been designed and tested to meet the expectations of ASME B31.3.

10.1 COUPLING CROSS-SECTION:



10.2 GENERAL ASSEMBLY CROSS-SECTION:



11. LLOYD'S REGISTER TYPE APPROVAL

The SRJ has completed a witnessed test regime from IACS P2, a full assessment of the design basis and a manufacturing audit, in order to gain Lloyds Register Type Approval for use in a variety of applications requiring high pressure fluid transmission in O&G, utilities, chemicals, processing and desalination. The manufacturer's of the SRJ currently includes John Mayes Engineering and Mussett Engineering in the UK, however the manufacturing can be located anywhere that has undergone the required audit by Lloyds.

The connector is fully compliant with ASME B31.1 (2012), ASME B31.3 (2012), ASME B31.4, ASME B31.8 (2012), ASME B31.9 (2011) and IACS P2 (2008).

Three sizes of connector were selected for testing: the SRJ 2 ½" SCH40, the SRJ 4" SCH40 and the SRJ 8" SCH40. The design pressure for each OD is 2603 psi, 1914 psi and 3967 psi respectively. This was to prove and agree a principal that can be applied to sizes in this range. Interpolation from 1 1/4" to 16" OD is allowed.

11.1 REPEATED ASSEMBLY TEST

This demonstrates that the SRJ can be disassembled for routine checks when required and still perform at a high level once reinstalled.

The SRJ was dismantled and reassembled ten times in accordance with the manufacturer's installation manual, and then subjected to a tightness test. The test was successfully conducted.

11.2 TIGHTNESS TEST

This demonstrates the performance of the SRJ at design pressure.

Without being longitudinally restrained, the SRJ was connected to the pipe, filled with test fluid and de-aerated. Pressure inside the SRJ assembly was increased to 1.5 times design pressure and maintained for five minutes. No leakage or drop in pressure was recorded. All three SRJ samples passed the tightness test.

11.3 BURST PRESSURE TEST

This demonstrates the SRJ's ability to withstand pressure surges in the pipeline by taking the connector to its yield point.

The SRJ assembly had to withstand a burst pressure of four times the design pressure. The assembly must not be restrained longitudinally and the pressure inside was progressively increased, then held for at least five minutes with no deformation, leakage or cracking. The test is based on IACs standards, which cover pressure-containing equipment and is therefore compliant with the European Pressure Equipment Directive (EPD). The 8" SRJ passed the test and its pressure-withstanding ability was successfully tested to nearly 17,000 psi.

11.4 EXTERNAL PRESSURE TEST

This demonstrates the performance of the SRJ in a high external pressure environment similar to a vacuum service or subsea.

An external pressure chamber was assembled around the connection, then filled with water and bled of all air. The pressure was increased in increments until it achieved 80% of the pipe bend yield stress and held for five minutes. Once 80% was achieved, the pressure was increased until the connection failed or the pipe collapsed. The 2 ½", 4" and 8" samples passed this test.

11.5 VIBRATION (FATIGUE) TEST

This test demonstrates SRJ's ability to withstand fatigue, which is likely to occur due to vibrations, under service conditions.

The SRJ assembly must not be restrained longitudinally. Two lengths of pipe were connected by the SRJ, with one pipe end rigidly fixed and the other fitted to the vibrating element on a cantilever type test rig. The assembly was filled with test fluid, de-aerated and pressurised to the design pressure of the SRJ. The test meets the requirements IACS P2 Rev.2 2001 (Rules for piping design, construction and testing) and all three SRJ samples passed.

11.6 PULL-OUT TEST

This demonstrates SRJ's ability to deal with axial loads likely to be encountered in service, without the connecting pipe becoming detached. Pipe lengths were fitted to each end of the SRJ and the assembly was pressurised to design pressure, in order to impose an axial load calculated according to a formula based on pipe OD and design pressure.

The load was maintained for five minutes and pressure monitored. There was no drop in pressure, signs of leakage, damage or movement between the SRJ and the connecting pipe. All three samples passed this test with no movement recorded.

The assemblies were then further tested (at the request of SRJ) so that whilst under design pressure, the pipes were assembled into a tension rig and the assembly axially loaded until breakage occurred. The 2 ½" sample demonstrated a break load of 30.39 tonnes, the 4" sample a break load of 66.5 tonnes and the 8" sample a break load of 418.18 tonnes, but without failure. The test on the 8" sample was stopped at that point because the test house insurance would not have covered damage to the test rig at additional pressure.

11.7 FIRE ENDURANCE TEST

ISO 19921:2005(E) and ISO 19922:2005(E): Ships and marine technology- fire resistance of metallic pipe components with resilient and elastomeric seals.

The SRJ and connecting pipes were subjected to an 800°C flame for thirty minutes, with an 80°C input temperature for the water flowing through the assembly and a maximum output temperature of 85°C. The velocity of flow had to at least 0.1 m^3 per second and the water pressure at 5 bar. Once the SRJ assembly was returned to ambient temperature, a five minute pressure test was conducted. All three samples passed the test.

11.8 COMBINED BENDING/PRESSURE TEST

This test demonstrated the SRJ's ability to withstand both axial loads and bending moments applied simultaneously. The SRJ was taken to 90% of the yield stress of the pipe material first by bending alone and then by combined bending and internal pressure. It was subjected to the required bending load while no internal pressure was applied and held for five minutes before the bending load was relaxed.

Since there was no residual deformation, the SRJ was pressurised to the design pressure and isolated. A reduced bending moment was then applied so that the combined stress in the wall of the pipe (axial stress from the internal pressure coupled with the bending stress) was equal to 90% of the yield stress of the pipe material.

This combined bending and pressure was held for a period of five minutes before the bending load was relaxed and the pressure relieved. During the test, the pressure was monitored and after completion of the test, there was to be no leakage or movement between the SRJ and the connecting pipes. The test was repeated but without internal pressure, to ascertain its strength without supporting internal pressure. All three SRJ samples passed the test.

A copy of the Certificate is included in the Appendix to the accompanying Coupling Installation Procedures.

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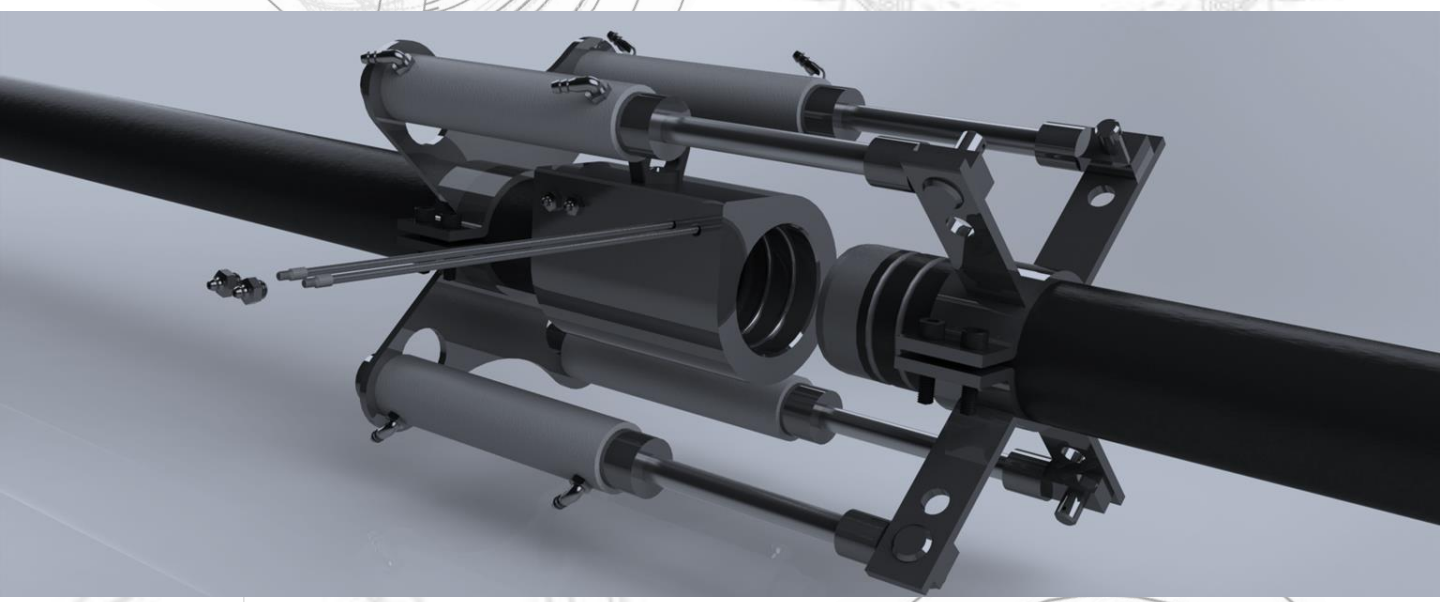
COUPLING

INSTALLATION PROCEDURES

COMBINING INNOVATION AND WORLD CLASS ENGINEERING



SNAP RING JOINT

SRJ

CONTENTS

1. DOCUMENT SCOPE

The following procedures cover the installation of the coupling.

The procedure specifically covers:

- The specification of the pipe preparation required to allow the SRJ coupling to be correctly installed.
- Detailed information covering the installation and removal of the SRJ coupling.

It is the responsibility of the installation contractor to correctly prepare the pipe ends either in a fabrication facility or by use of portable in-situ machining equipment that is capable of achieving the required specification.

2. SAFETY

The coupling must be installed and the pipes prepared by competent personnel who are trained in the safe use of installation equipment and who are capable of working in a safe and proper manner.

Please read and fully understand these procedures before attempting to install any SRJ coupling.

PERSONAL PROTECTIVE EQUIPMENT (PPE).

Minimum PPE safety requirements are listed below, however site specific safety requirements and results of risk assessments should be considered prior to commencing work.

- Approved non slip safety boots with internal steel toecap;
- Safety helmet approved to BS EN 397 : 1995;
- Safety spectacles approved to BS EN 166 - 1F minimum; and
- Cut resistant safety gloves

A risk assessment of the SRJ coupling installation and application for which it is destined, must be undertaken prior to commencement of works, and recommendations adopted that will mitigate any risk. It is mandatory that a work permit is obtained stating that the line is depressurised and clean before commencing any installation/pipe preparation work.

3. HANDLING

SRJ couplings can weigh more that the recommended maximum weight permitted to be manually lifted. Therefore, always use appropriate lifting equipment and certified slings when handling the couplings. An eye bolt hole is located within the coupling which can be used by screwing in the correct eye bolt.

Ensure that all industry regulations and practices are adhered to and ensure no one is allowed to work beneath suspended loads.

4. COUPLING DESCRIPTION

The SRJ coupling comprises three key elements:-

1. Pressure Containing Sleeve

The sleeve is manufactured from a single piece forging in materials that are compatible with the pipe content and spans the two pipe ends being connected.
The inner periphery of the sleeve is machined to accept the systems load retaining wires and sealing system.

2. Retaining Wires

The retaining wires are fed into the inner coupling grooves, which align with grooves machined into the pipes outer surface. The pipe groove depth is calculated and verified by testing to ensure that the pipe's pressure capacity is not reduced. Extensive testing and design analysis has been undertaken which demonstrates that under pressure, the pipe's strength is not reduced due to the machined groove.

The wires are constructed from counter-wound strands of high quality steel to ensure both strength and flexibility.

Once installed, the wires are locked into position and a suitable corrosion inhibitor injected, which must be compatible with the elastomeric seals.

3. Sealing System

The sealing system is based upon high integrity elastomeric seals that seal onto the periphery of the pipe. Two types of seals are used, either a Nitrile (HNBR) 'Casing Seal' which comprises a solid seal with built in metallic anti-extrusion rings or a Viton Lip Seal. Please check the project information sheet in Appendix I as to which type has been supplied with the coupling.

The seals are initially energised during installation of the coupling, with the initial contact stress being sufficient to initiate the sealing process.

5. COUPLING SPECIFICATION

Having been provided with a Product Information sheet (Appendix I), SRJ engineers will provide a Product specification sheet. The intended application should be compared to the specification sheet and if the pipe is outside the limits specified then the coupling must not be fitted and Snap Ring Joint Limited contacted immediately.

The coupling markings should be checked to ensure the coupling has been supplied as specified.

The coupling must not be installed on any application where it will see pressures or temperatures outside what is specified in these procedures/stamped on the body of the coupling.

The coupling is supplied pre fitted with the two radial seals and the retaining wires packaged separately.

6. PIPE SPECIFICATION – PREPARATION.

The pipe should be checked for both diametrical and ovality tolerance to ensure that it is within the API 5L specification.

The pipes' outer surfaces should be machined in accordance with the pipe preparation specification (provided on request)

Please Note: The Viton Lip seal requires the outer surface of the pipe in the area from the pipe end to the seal contact point to be machined. Once machined all tool marks must be removed. The minimum pipe diameter specified must be respected.

The depth of the grooves is critical to the correct performance of the coupling and must be machined accurately by the use of a form tool. The depth of groove must be checked post machining by the use of a dial gauge indicator. If the maximum depth of groove has been exceeded then the coupling should not be fitted. The area of machined groove must be cut out and the work re started.

Particular attention must be paid to the pipes surface area in the region of the seal contact point. This area must be free from any defects/tool marks /dents etc. and be of clean metal i.e. with no paint /surface coatings.

The two pipes being connected must be capable of being aligned within the same plane and the pipe ends must be allowed to come into contact if they were aligned prior to coupling installation.

- Always ensure that a new seal is used. Do not re-use old seals.
- Always ensure that new retaining wires are used. Do not re-use old wires.
- Ensure that the wires are in good condition and that they have not begun to de- laminate.

The wires should be coated with a light lubricant prior to installation which will aid installation and give protection. All surfaces of the coupling and pipe ends must be clean and free from debris.

7. COUPLING INSTALLATION.

1. Mark both prepared pipes with a circumferential line at a distance equal to 50% of the coupling's overall length from each of the pipe ends. This 'setting line'/datum indicates the position where each end of the SRJ will be located once installed.

   Coupling alignment to this datum ensures that the wires can be easily inserted into their grooves.

   If required, a simple two bolt positioning clamp can be aligned to the 'setting' distance on the pipe, which will aid installation.
2. Lubricate the machined pipe surfaces (chamfers and grooves) and the seals inside the SRJ with a lubricant such as a light soap solution or grease. The lubricant selected must be fully compatible with the elastomeric seal compound.
3. The SRJ is delivered with two elastomeric seals pre-installed, four retaining wires with terminations and four locking grub screws. In the case of the Lip Seal version, anti-extrusion rings are also fitted.
4. Prior to installation, check that all seals are free from any cuts or abrasions. If in doubt change out the seals.
5. If any defects are found within the coupling, reject the unit and use a replacement. Please return the coupling to Snap Ring Joint Limited for replacement.
6. Safely rig the SRJ coupling and align with the first pipe end onto which it will be installed using the appropriate lifting eyes. (if applicable).

7. The SRJ coupling can now be pushed over the pipe end until it aligns with the retaining clamp /setting line. For larger dimension couplings, (i.e. over 6"OD) a hydraulically operated installation tool is available.
8. Insert one of the two retaining wires into one of the wire access holes in the side of the SRJ sleeve that is adjacent to the pipe end. When just the end of the wire with the termination is visible, screw the insertion tool into the termination (which has a female thread) and push into the access hole until the wire is no longer visible, and reaches a stopping point. Close the entrance of the wire access hole with a locking grub screw.
9. The wire should be easy to insert but in the event that the wire is difficult to insert the coupling's position should be slightly adjusted as it is likely that the coupling/pipe grooves are not in correct alignment. Repeat this process for the second wire on the same side of the SRJ sleeve
10. Align the second pipe and pull into the open end of the coupling by means of suitable rigging equipment / SRJ handling tools.
11. Once the second pipe is completely pulled within the coupling (pipe ends in contact) the retaining wires should be inserted as above.

In the event that the coupling is fitted with grease nipples, then at this stage the corrosion inhibitor can be injected between the coupling/pipe annulus around the retaining wires.

8. COUPLING REMOVAL

Prior to removing an SRJ coupling a permit to work must be obtained stating that the line is safe to work on. Please verify that the line is depressurised and vented.

Suitable rigging / lifting equipment should be used if the couplings weight is about that which can be safely manually handled. Attach the rigging equipment to the eye bolt hole located in the coupling.

1. Remove the grub screws protecting the retaining wires.
2. Attach the retaining wire reparation tool by screwing in clockwise (making sure not to damage any of the mating threads).
3. Rotate and pull the retaining wire until it is completely removed from the coupling.
4. In the event that the wire cannot be removed the coupling will need to be rotated/ the pipes manipulated. This movement will free the wires.
5. The pipes can now be pulled from the coupling or the coupling slid along the pipe.
6. If the coupling is to be reused it is important that it is inspected for any internal damage prior to re installing. New retaining wires and seals must be fitted.

9. DOCUMENTATION

Upon completion of the installation, an SRJ installation report must be completed. A copy should be sent to Snap Ring Joint Limited.

10, PIPE PREPARATION

10.1 MACHINE DESCRIPTION

The tool used is a globally available split frame pipe preparation machine that is capable of performing the following operations

- Pipe cutting
- Pipe end preparation
- SRJ groove preparation
- Machining of the area under the seal

The machine can be either hydraulically or pneumatically driven, with the motor positioned in line with the machine or at right angles, depending upon access requirements.

The machine comprises 4 adjustable legs which ensure that the machine can be accurately positioned onto the outside of the pipe. To speed up installation 2 of the legs can be factory set to suit the specific pipe diameter being machined.

Two types of tool boxes are used, one to initially cut the pipe (if required) and to machine the grooves. The second is used to machine the seal area.

The tool boxes and motor are generic items of equipment and are designed to suit the full range of gear rings, each of which are sized to suit the precise pipe diameters 2" to 8", 6" to 12", 12" to 16".

The equipment to suit up to 12" NB pipe can be easily handled by two people. Above this size suitable lifting equipment will be required.

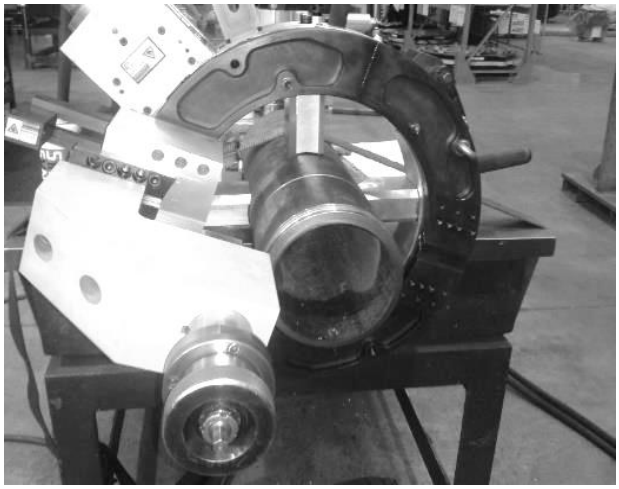
10.2 EQUIPMENT SET UP

The pipe open end is used as the datum for all the machining operations and the machine is mounted on the pipe a set distance from the pipe end and the legs locked in place.

A magnetic based dial gauge indicator is attached to the machine and used to ensure the machine is positioned both square and concentric to the pipe. The mounting legs are adjusted as the machine is rotated and alignment measurements taken with the gauge.

Once this set up is complete the machine is not then moved as all machining operations are completed from this position.

It is anticipated that the equipment set up will take between 45 minutes.



6 TO 12" SHOWING MOUNTING LEGS AND TURNING ARM.

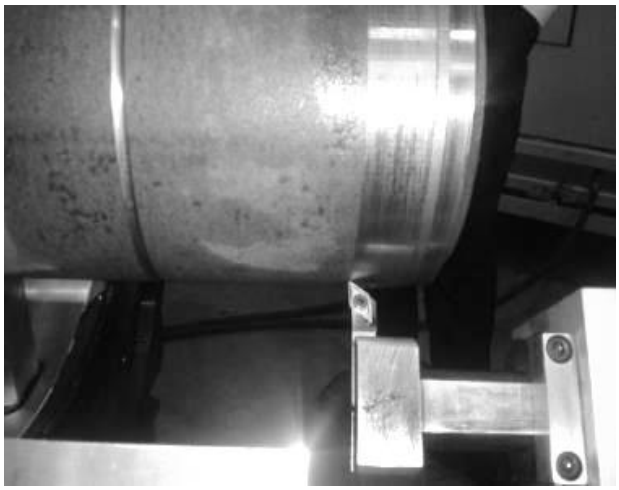
10.3 MACHINING

The turning arm is attached to the face of the machine and is first used to face the end of the pipe ensuring that it is square to the pipes axis and that the position from the end of the pipe to the face of the machine is as specified in the procedures.

The tool is then adjusted so that it is set to machine the surface of the pipe in the area of the seal. The 1st 10mm of the pipe end can be used to test cut and ensure the diameter is correct (machined to minimum pipe diameter). Once correct the tool box is locked in position and the tool is manually fed along the length of the pipe to the desired distance.

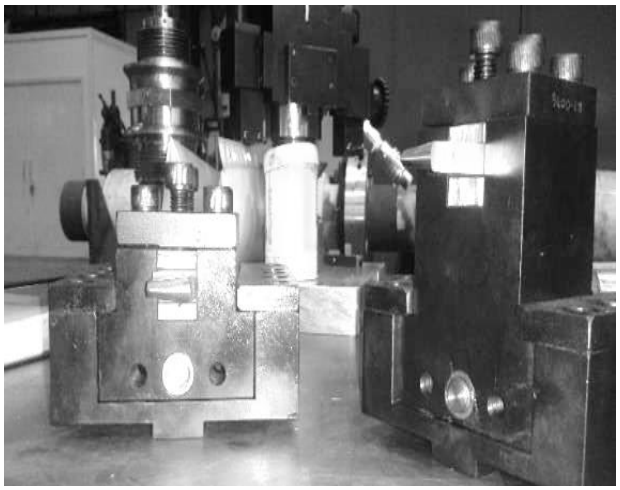
Once completed the tool is then used to cut the required seal lead in at the end of the pipe (chamfer).

This operation is anticipated to take 30 minutes



SEAL AREA BEING MACHINED TO N9 FINISH.

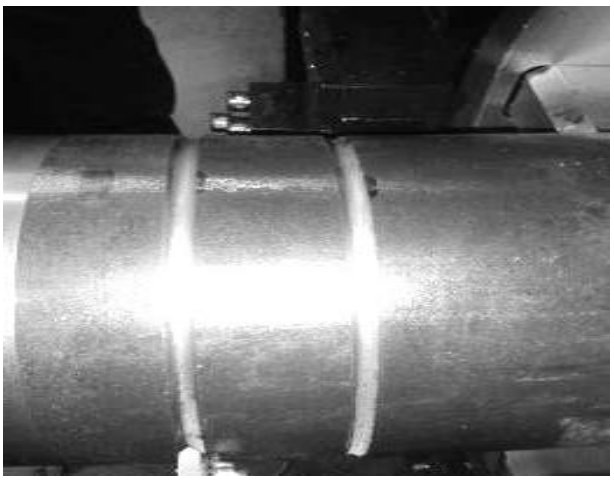
The tool box is then removed and twin boxes are attached 180 degrees apart to the face of the machine. Each box contains a form tool sized to the required groove. Each tool is held in the box spaced with pre-set packers, which ensure that the position of the grooves is exactly to specification.



GROOVE TOOL BOXES SHOWING PACKERS TO ACCURATELY SET SPACING.

Once locked in place the boxes are automatically fed into the pipe cutting the grove, the depth is controlled by the number of revolutions of each tool box feed wheel. The grooves are cut simultaneously. The grove cutting operation is completed within 10 minutes.

GROOVES BEING SIMULTANEOUSLY MACHINED..



GROOVES CUTTING NEARING COMPLETION..

Lloyd's Register

Type Approval Certificate Extension

This is to certify that Certificate No. 12/00064 for the undernoted products is extended and renumbered as shown.

This certificate is issued to:

PRODUCER	Snap Ring Joint Ltd 17 Esplanade St Helier Jersey, JE2 31A United Kingdom (UK)
PLACE OF PRODUCTION	John Mayes Engineering Ltd 13 Roman Road Thetford Norfolk, IP24 1XB United Kingdom (UK)
DESCRIPTION	Machined grooved type pipe coupling using a snap ring joint.
TYPE	SRJ
APPLICATION	For joining steel pipes in offshore and industrial applications.
STANDARD	ASME B31.1 - 2012; ASME B31.3 - 2012; ASME B31.8 - 2012; ASME B31.9 - 2011; IACS UR, No. P2.

Certificate No.	12/00064(E1)
Issue Date	17 June 2013
Expiry Date	11 October 2017
Sheet	1 of 2

DG Hardacre
Energy – Downstream, Power and Manufacturing
Lloyd's Register EMEA

Lloyd's Register EMEA
71 Fenchurch Street, London EC3M 4BS

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RATINGS

Pipe diameter (inch):	1.25, 1.5, 2, 2.5, 3, 4, 6, 8, 10, 12 14 & 16
Wall thickness:	Sch STD, Sch 40, Sch 60, Sch 80, Sch 100 Sch 120, Sch 140, Sch 160, Sch XS & Sch XXS,
Temperature range (°C):	- 29 to + 170 *

* The use of couplings outside of the temperature range stated above, shall be determined by the prevailing service conditions and limitations of the steels and elastomeric seals employed. For example, sub zero applications would require both low temperature steels and low elastomeric seals.

Refer to Snap Ring Joint Ltd drawings for actual pressure and permitted wall thicknesses for each specific coupling diameter.

It is the responsibility of SRJ Ltd to ensure that their design methodology submitted to Lloyds Register EMEA provides the basis of the design for future SRJ couplings, within the stated parameters of this approval.

OTHER CONDITIONS

1. The couplings are not approved for use in systems subject to pressure pulsation other than water hammer.
2. Pipe ends are to be prepared and machined in accordance with Snap Ring Joint Ltd's drawings and instructions.
3. Where alternative materials are used in the construction of the coupling, they shall comply with the requirements of the standards listed above e.g. ASME B31.3, in particular with respect to the allowable stress at the design temperature under consideration.

"This Certificate is not valid for equipment, the design, ratings or operating parameters of which have been varied from the specimen tested. The manufacturer should notify Lloyd's Register EMEA of any modification or changes to the equipment in order to obtain a valid certificate."

The attached Design Appraisal Document No.12/00064(E1) and its supplementary Type Approval Terms and Conditions form part of this Certificate.

All other details remain as the previous Certificate No. 12/00064 to which this extension should be attached.

Certificate No.	12/00064(E1)
Issue Date	17 June 2013
Expiry Date	11 October 2017
Sheet	2 of 2

DG Hardacre

DG. Hardacre
Energy – Downstream, Power and Manufacturing
Lloyd's Register EMEA

Lloyd's Register EMEA
71 Fenchurch Street, London EC3M 4BS

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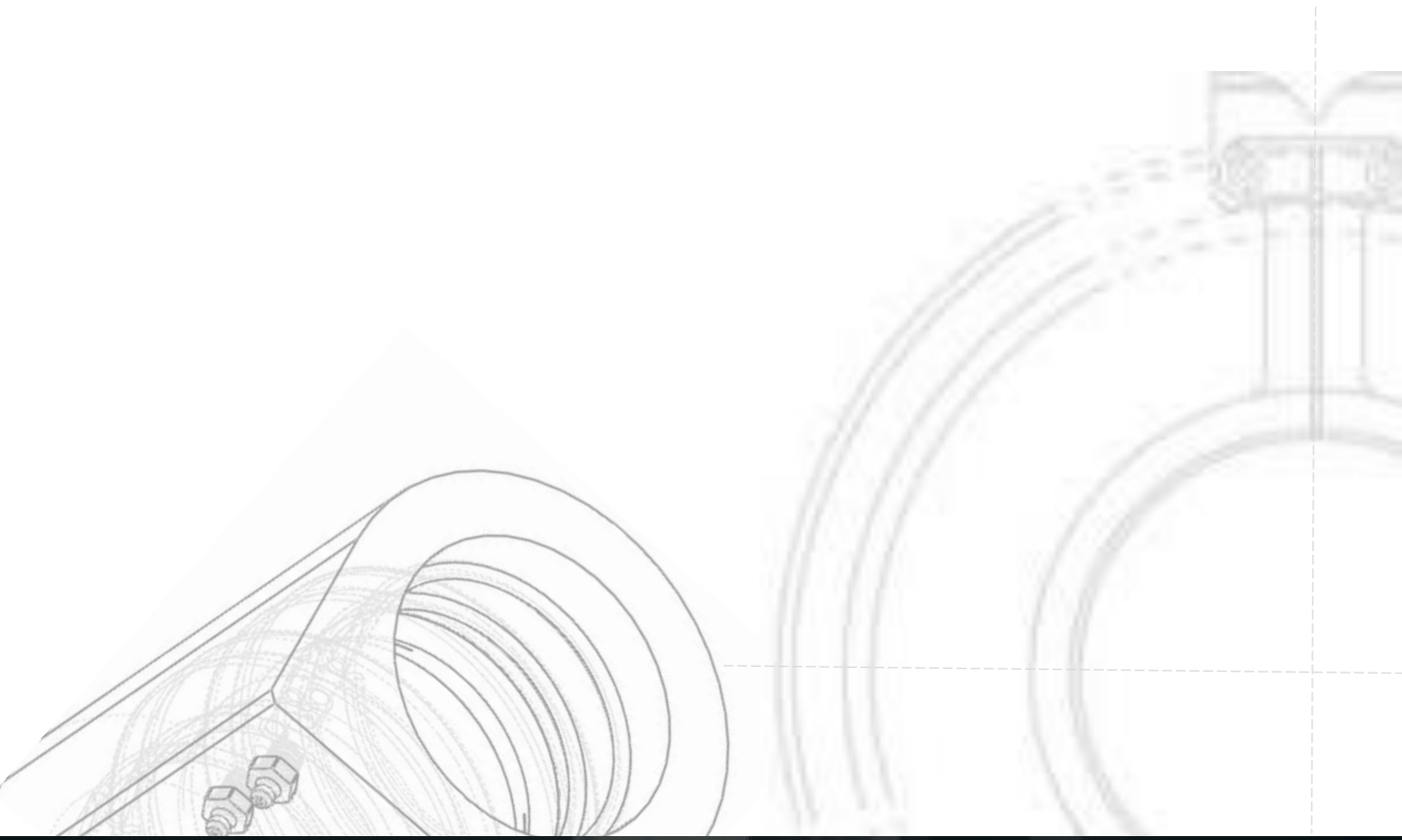
SNAP RING JOINT
PROJECT INFORMATION SHEET

SRJ Reference #:	
Customer:	
Contact person:	
Telephone:	
Email:	
Date:	
Project name/ location:	
Customer reference:	

Application Details	
Piping specification:	
Nominal pipe size: (nominal bore N.B)	
Pipe outside diameter (OD):	
Pipe material specification:	
Wall thickness/Schedule:	
Temperature:	Minimum: Maximum:
Line operating & Max design pressure:	& (psi / bar)
Line pressure rating:	(API / ANSI)
Line hydrotest pressure:	(psi / bar)
Corrosion allowance:	
Seam welded or seamless pipe?	
Line contents:	
Sour service:	Yes No
Topside/ Onshore /Subsea:	
Pipe design life:	
Coating required:	
Coupling external test facility:	Yes No
SRJ configuration: (If other please specify)	(Pipe / Pipe) (Blind) (Flange Termination) (Other)
Quantity required:	

QA	
Factory pressure test	Yes No
Third party inspection	Yes No
Name and signature	



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