XLC-S, XLC-S-RB, and XLC-S-HS Connectors

The XLC-S connector is XL Systems second-generation wedge connector designed for exceptional performance in structural applications where connector strength and fatigue performance are primary design drivers. XLC-S connectors are commonly used in offshore well conductor applications for both shallow water and deepwater projects.

XL Systems developed the second-generation XLC-S connector to address an industry need for enhanced connector strength and fatigue performance in shallow water conductor applications. This connector has demonstrated excellent service in this application for nearly 25 years. Successful use in shallow-water projects and a general industry move to deepwater drilling has added many deepwater projects to the XLC-S connector service portfolio.

The XLC-S connector design is a dovetail wedge thread design. The tapered wedge thread design provides for deep stabbing, low-torque spin-up, and fast make-up times. The dovetail thread shape keeps threads engaged even under extreme overload conditions.

XLC-S connectors are generally supplied in an integral-threaded configuration with pin and box threads machined directly onto the pipe joint ends. This produces an ideal connector geometry of true flush OD and flush ID. Higher-strength, weld-on XLC-S-RB and XLC-S-HS connectors are also available based on the original XLC-S design.

XLC-S connectors have more than 25 years of successful field service history in shallow water and deepwater conductor and drive pipe applications. XLC-S connectors are 'fatigue-rated' and are suitable for installation by pile driving.

XLC-S, XLC-S-RB, and XLC-S-HS connectors are available in

20- to 48-inch

sizes

suitable for onshore and offshore conductor applications

Typical Applications

- Platform conductors or drive pipe
- Jackup exploratory well conductors
- Subsea well conductors or jet strings
- Conductor-supported platforms

XLC-S Connectors

Unique Features and Benefits

Wedge Thread Technology
Wedge thread connectors have unique make-up and performance characteristics which enable robust and reliable field performance: deep-stabbing, low-torque spin-up, slim connector profiles, high strength efficiency, and high torque resistance.

Dovetail Thread Shape
Negative load flank and stab flank angles produce a dovetail thread shape which prevents thread jumpout under extreme loading conditions.

Fully Driveable
XLC-S connectors are designed and tested for conductor installation by pile driving. Full-scale pile driving fatigue testing data are available.

Fatigue-Rated and Tested
Comprehensive fatigue testing and analysis data demonstrate structural reliability in harsh environment applications. Integral-threaded XLC-S connectors eliminate pipe-to-connector welding. This girth weld often controls fatigue life for large-bore weld-on connectors.

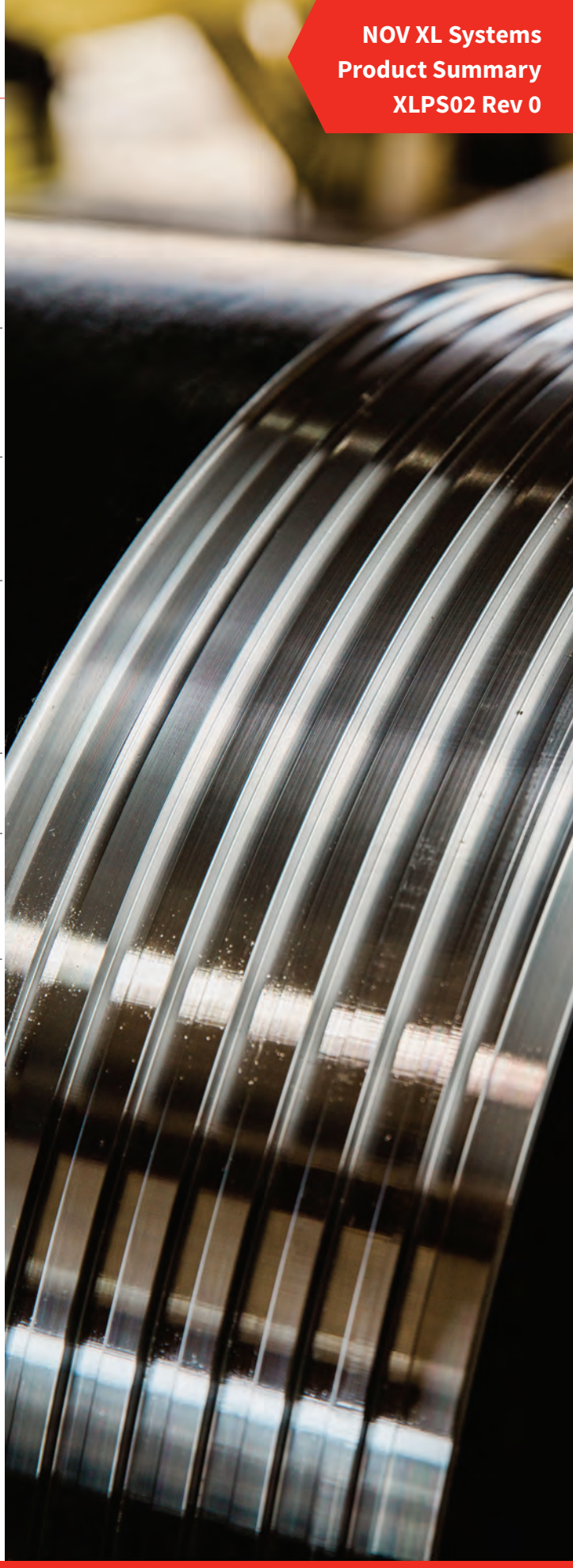
Seawater Exclusion Seal
External metal seal prevents corrosion in the connector threads.

Proven Performance
Extensive full-scale testing plus over 25 years of successful field service history make XLC-S connectors a robust and proven solution for structural applications.

Three Connector Configurations
XLC-S Connectors: Integral-threaded pin and box connectors produce the ideal connector geometry of a true flush ID and true flush OD profile. Connector strength efficiency ranges from 60% to 85% of full pipe body strength depending on size. Integral-threading is the most cost-efficient large-bore connector design.

XLC-S-RB Connectors (Reduced Bore): Standard XLC-S connector threads are machined into thicker-wall ring sections welded to pipe ends. XLC-S-RB connectors have strength ratings that meet or exceed full pipe body strength. The connector profile is flush OD with a slightly reduced bore dimension.

XLC-S-HS Connectors (High Strength): Standard XLC-S connector threads are machined into higher-grade ring sections welded to pipe ends. Weld-on rings match pipe body dimensions producing a flush OD and flush ID connector profile. The higher connector material strength increases strength ratings to meet or exceed pipe body strength in many configurations.



XLC-S Connectors

20- to 48-inch Sizes

XLC-S connectors utilize XL Systems second-generation wedge threadform, designed for robust and reliable performance as conductors or structural strings in offshore and onshore well construction projects. The wedge thread design provides for easy handling and fast connector make-up on the rig.

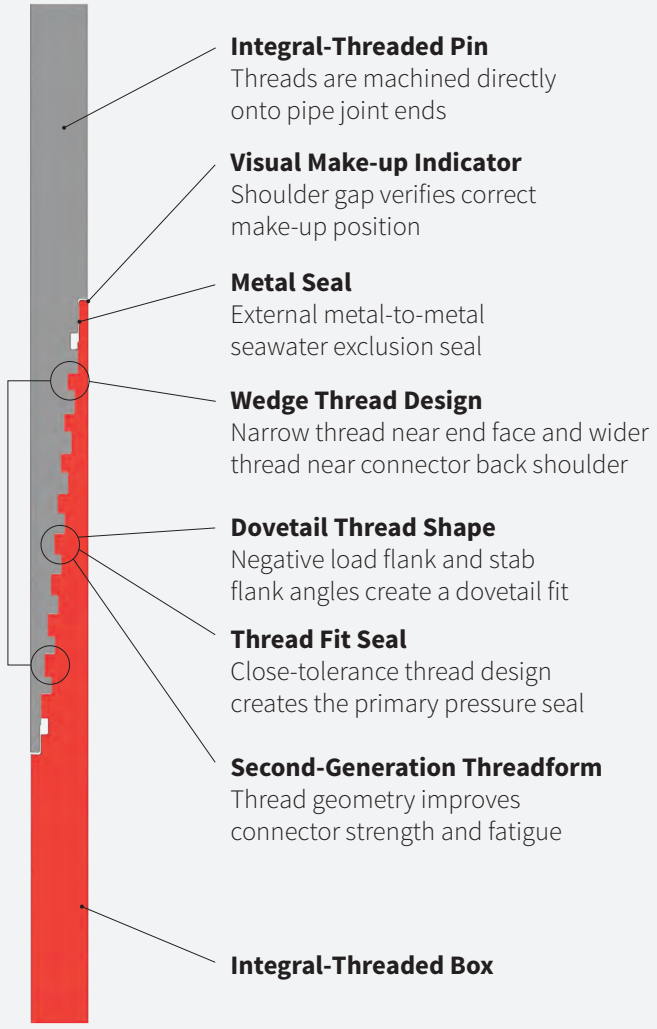
Figures on this page show the integral-threaded XLC-S connector configuration with pin and box threads machined directly onto the pipe joint ends. This produces the ideal connector geometry of a true flush OD and flush ID profile. Integral-threaded XLC-S connectors typically have connector strength efficiency ranging from 60% to 85% of pipe body structural strength.

Handling large-bore, flush OD connectors can be a challenge. XLC-S connectors can be supplied with multi-function lifting devices called 'PDLs' which act as a thread protector, drive adapter, and include a lift shoulder for handling joints with standard casing running tools like elevators.

XLC-S connectors share favorable field make-up characteristics with all XL Systems wedge connectors: fast make-up, deep stabbing, low-torque spin-up, high torque capacity, and built-in resistance to unintended back-off.

The XLC-S connector is a dual-seal design. The primary pressure seal is the thread fit seal. A secondary external metal seal is included and works primarily as a seawater exclusion seal.

XLC-S connectors make-up in approximately 3 turns from stab to full make-up and do not require a mechanical anti-rotation device to prevent unintended connector back-off.



XLC-S-RB Connectors

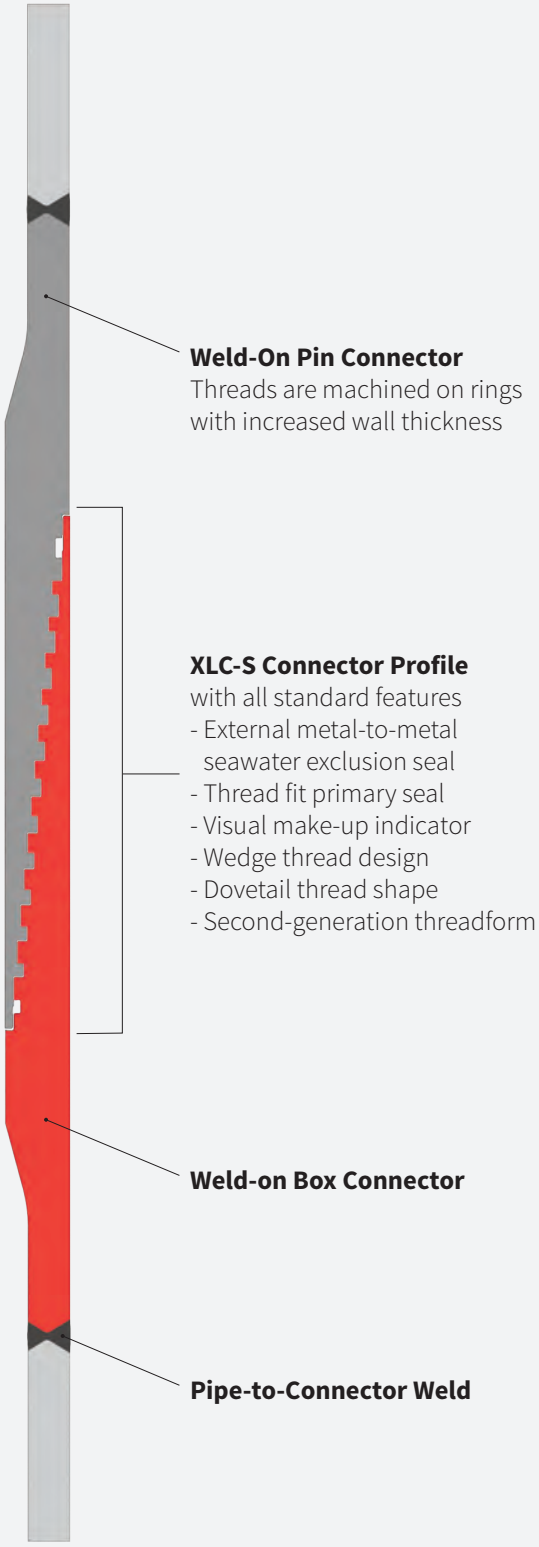
20- to 48-inch Sizes

Illustrations on this page show the weld-on XLC-S-RB (reduced bore) connector configuration. Standard XLC-S connector pin and box profiles are machined into thicker-wall ring sections welded to pipe joint ends. The increased wall thickness at the pin and box connectors increases connector strength to meet or exceed full pipe body strength in most configurations.

XLC-S-RB connectors are intended for use in structural applications where a flush OD connector profile and full pipe body strength are desired or required. The grade and wall thickness of the weld-on connector rings can be optimized to meet wide ranging connector strength and fatigue design criteria.

Since XLC-S-RB connectors use the same wedge thread design as standard XLC-S connectors, handling and make-up characteristics are identical to XLC-S connectors: fast make-up, deep stabbing, low-torque spin-up, high torque capacity, and built-in break-out resistance.

XLC-S-RB connectors make-up in approximately 3 turns from stab to full make-up and do not require a mechanical anti-rotation device to prevent unintended connector back-off.



XLC-S-RB Connectors

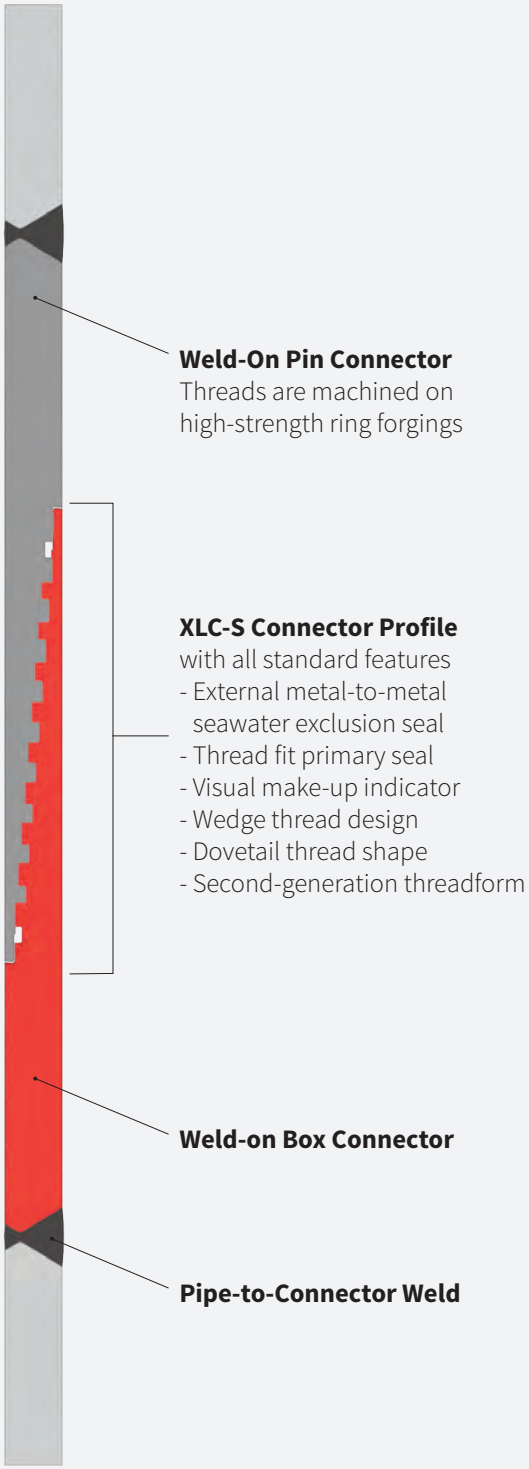
20- to 48-inch Sizes

Illustrations on this page show the weld-on XLC-S-HS (high-strength) connector configuration. Standard XLC-S connector pin and box profiles are machined into higher-grade ring forgings welded to pipe joint ends. The increased material strength at the pin and box connectors increases connector strength to meet or exceed full pipe body strength in many configurations.

XLC-S-HS connectors are intended for use in structural applications where flush OD and flush ID connector profiles are desired and where integral-threaded XLC-S connector strength ratings do not meet design criteria. Several standard forging grade options are available to match XLC-S-HS connector strength ratings to project design criteria.

Since XLC-S-HS connectors use the same wedge thread design as standard XLC-S connectors, handling and make-up characteristics are identical to XLC-S connectors: fast make-up, deep stabbing, low-torque spin-up, high torque capacity, and built-in break-out resistance.

XLC-S-HS connectors make-up in approximately 3 turns from stab to full make-up and do not require a mechanical anti-rotation device to prevent unintended connector back-off.



PDL Subs

A common method of running and handling pipe with flush-profile XLC-S, XLC-S-RB, and XLC-S-HS connectors is to use a PDL (**P**rotecting, **D**riving, **L**ifting) sub. This device is simply a short length of pipe threaded with a complete connector thread. The PDL device is a multi-function tool, serving as a thread protector, a drive sub for pipe installed by pile driving, and as a lifting tool or 'lift nubbin'.

The PDL sub provides robust protection against impact damage to the connector threads, metal seals, and thin end faces during transportation and handling. Lifting holes on the PDL provide convenient options for lifting and handling single joints during transportation and bringing joints to the rig floor. A lifting ring on the PDL provides an interface for elevators lifting single joints into the derrick and for lifting and lowering the full string weight on the rig.

In pile driving applications, pile driving forces are transmitted through the XLC-S connector threads. A properly installed PDL sub is required at the top end of each joint during driving to serve as the interface between the conductor string being driven and the pile driving hammer or drive chaser. The permanently attached lift shoulder on the PDL is fully compatible with pile driving forces. Flush OD connectors handled with removable lift rings often require sending a man into the derrick to remove the lift ring before landing out the hammer. Pile driving with PDLs eliminates the need for this dangerous operation.

In some pipe sizes, usually larger-diameter or heavier-wall sizes, joints are shipped with PDLs pre-installed in each joint. In other cases, usually smaller-diameter sizes, joints are shipped with conventional composite (plastic) protectors installed plus a small number of swappable PDLs for running and handling pipe on the rig.

PDLs are often supplied as rental tools which are returned to XL Systems at the end of the job.

Connector Performance Data Sheets

XL Systems maintains a library of connector performance data sheets or 'spec sheets' for all of our connector products on the nov.com website. Select the **Specs Direct** link from the XL Systems homepage at **nov.com/xlsystems.** Pipe and connector performance data change from time to time and users are encouraged to obtain up-to-date product data for each project.

Connector Material Grades

XLC-S connectors are integral-threaded directly on the pipe body, so connector material grade is the same as the pipe grade. Weld-on rings for XLC-S-RB connectors are manufactured to either API 5L pipe grade requirements or XL Systems ring forging specifications. Weld-on ring forgings for XLC-S-HS connectors are manufactured to XL Systems forging material specifications. The following table provides common pipe and connector grade combinations. Other forging grades with higher strength or special alloying are also available.

Recommended Connector Grades based on API 5L Pipe Grade

API 5L Pipe Grade	XLC-S Connector Grade	XLC-S-RB Connector Grade Options	XLC-S-HS Connector Grade Options
X52	X52	Pipe grades X52 or higher Forging grades M70, M80, M95	Forging grades M70, M80, M95
X56	X56	Pipe grades X56 or higher Forging grades M70, M80, M95	Forging grades M70, M80, M95
X65	X65	Pipe grades X65 or higher Forging grades M70, M80, M95	Forging grades M70, M80, M95
X70	X70	Pipe grades X70 or higher Forging grades M70, M80, M95	Forging grades M80, M95
X80	X80	Pipe grade X80 Forging grades M80, M95	Forging grade M95

Connector Material Properties

Connector Grade	Minimum Yield Strength	Material Specification
X52	52.2 ksi = 360 MPa	API 5L
X56	56.6 ksi = 390 MPa	API 5L
X65	65.3 ksi = 450 MPa	API 5L
X70	70.3 ksi = 485 MPa	API 5L
X80	80.5 ksi = 555 MPa	API 5L
M70	70.0 ksi = 483 MPa	NOV XL Systems
M80	80.5 ksi = 555 MPa	NOV XL Systems
M95	95.0 ksi = 655 MPa	NOV XL Systems

Field Service Procedures

See the following XL Systems field service procedures for additional information on running and handling pipe with XLC-S, XLC-S-RB, and XLC-S-HS connectors:

FSPXL0007 Wedge thread connector storage, inspection, and repair

FSPXL0011 XLC-S connector field service procedure

FSPXL0019 Approved thread compounds