

XL Systems

XLF, XLF-RB, and XLF-HS Connectors

The XLF connector is XL Systems first-generation wedge thread connector designed as a cost-efficient solution for large-bore surface casing and liner string applications where pressure containment is the primary design driver.

XL Systems developed the integral-threaded XLF connector over 30 years ago as a cost-effective alternative to large-bore weld-on connectors. The industry has evolved to more demanding casing and connector performance requirements and the XL Systems product line has evolved to meet these changing conditions. However, the original XLF connector still uniquely satisfies a market segment for large-bore, flush-profile connectors with full pipe body pressure ratings.

The XLF connector design, like all subsequent XL Systems wedge thread connector designs, 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. XLF connectors feature a

robust metal-to-metal primary pressure seal plus a secondary thread-fit seal.

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

XLF connectors have more than 30 years of successful field service history in onshore, offshore shallow water, and offshore deepwater conductor, surface casing, and liner string applications.

XLF, XLF-RB, and XLF-HS connectors are available in
20- to 48-inch
sizes

suitable for onshore and offshore surface casing and liner string applications

Typical Applications

- Surface casing strings
- Downhole liner strings
- Slim-hole wells with tight annular clearances
- Drilling with casing

XLF 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.

Dual Seal Design

The XLF connector primary pressure seal is a metal-to-metal seal on the ID side of the threads near the pin nose. A secondary thread-fit seal provides backup pressure resistance.

Full Pipe Body Pressure Ratings

XLF connector internal and external pressure ratings match full pipe body capacity in most configurations. Note that XLF connectors are intended for liquid pressure service, not gas.

Proven Performance

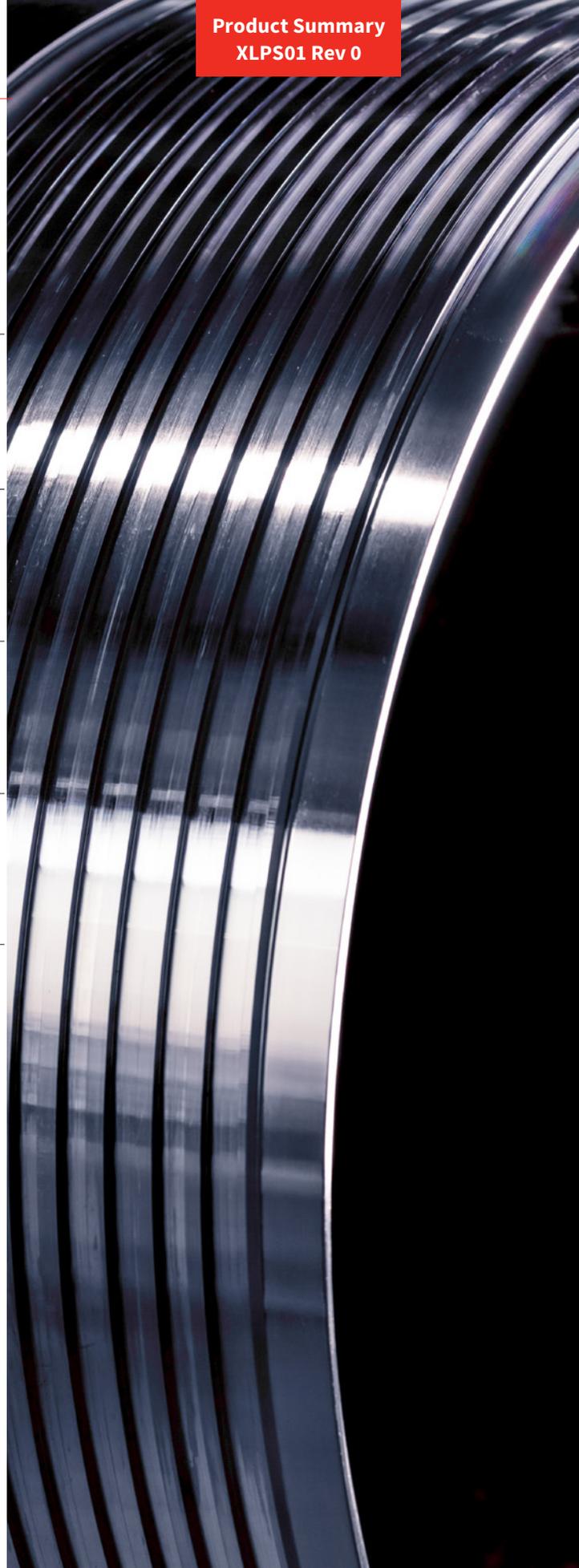
XLF connectors have an extensive and successful field service history spanning over 30 years and including a wide range of onshore and offshore conductor and casing string applications.

Three Connector Configurations

XLF Connectors: Integral-threaded pin and box connectors produce the ideal connector geometry of a true flush ID and true flush OD profile. Connector tension, compression, and bending strength efficiency ranges from 50% to 70% of full pipe body ratings depending on size. Integral-threading is the most cost-efficient large-bore connector design.

XLF-RB Connectors (Reduced Bore): Standard XLF connector threads are machined on thicker-wall ring sections welded to pipe ends. XLF-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.

XLF-HS Connectors (High Strength): Standard XLF connector threads are machined on 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 material strength increases connector strength ratings to meet or exceed pipe body strength in many configurations.



XLF Connectors

20- to 48-inch Sizes

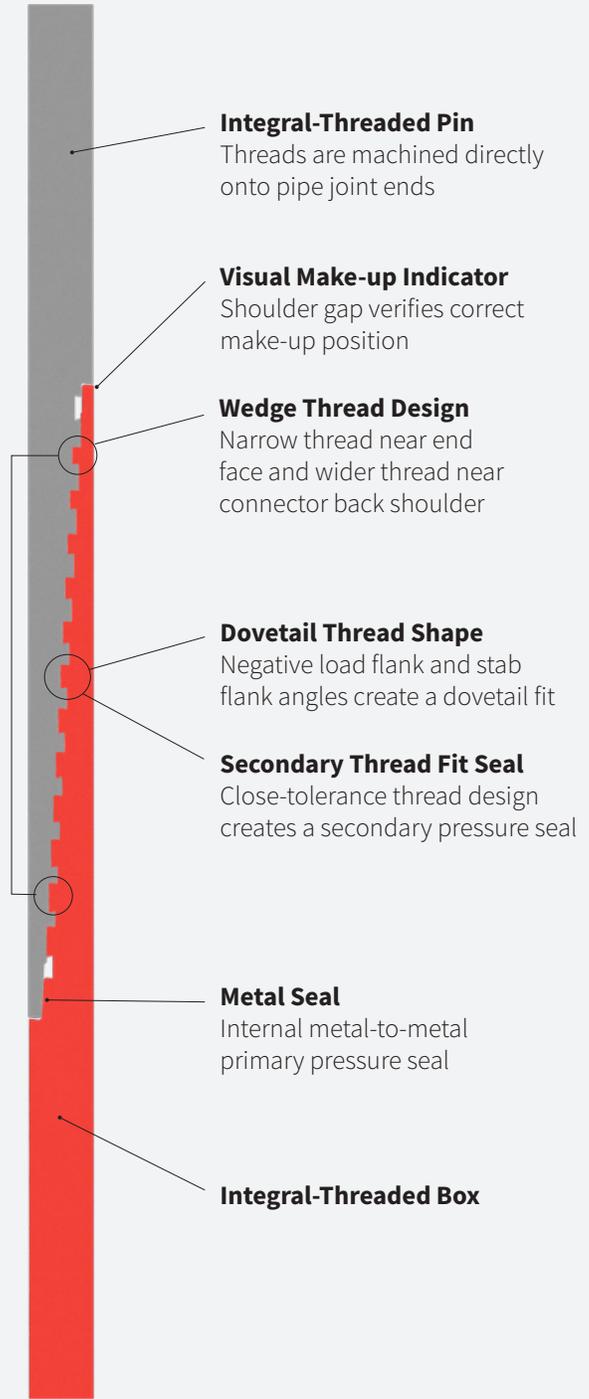
Figures on this page show the integral-threaded XLF connector configuration with pin and box threads machined directly onto the pipe joint ends. This produces the ideal connector geometry of a true flush OD and flush ID profile. Integral-threaded XLF connectors have internal and external pressure ratings that match full pipe body ratings. Connector tension, compression, and bending capacities typically range from 50% to 70% of pipe body capacity.

The XLF connector is a dual-seal design with an internal metal-to-metal primary pressure seal. The tight-fitting tapered wedge thread provides a secondary thread-fit seal. XLF connectors are intended for use on casing strings where liquid pressure containment is a primary design driver.

Handling large-bore, flush OD connectors can be a challenge. XLF 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.

XLF 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.

XLF 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.



XLF-RB Connectors

20- to 48-inch Sizes

Illustrations on this page show the weld-on XLF-RB (reduced bore) connector configuration. Standard XLF 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.

XLF-RB connectors are intended for use in heavily-loaded surface casing string applications where a flush OD connector profile, full pipe body pressure ratings, and full pipe body structural 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 design criteria.

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

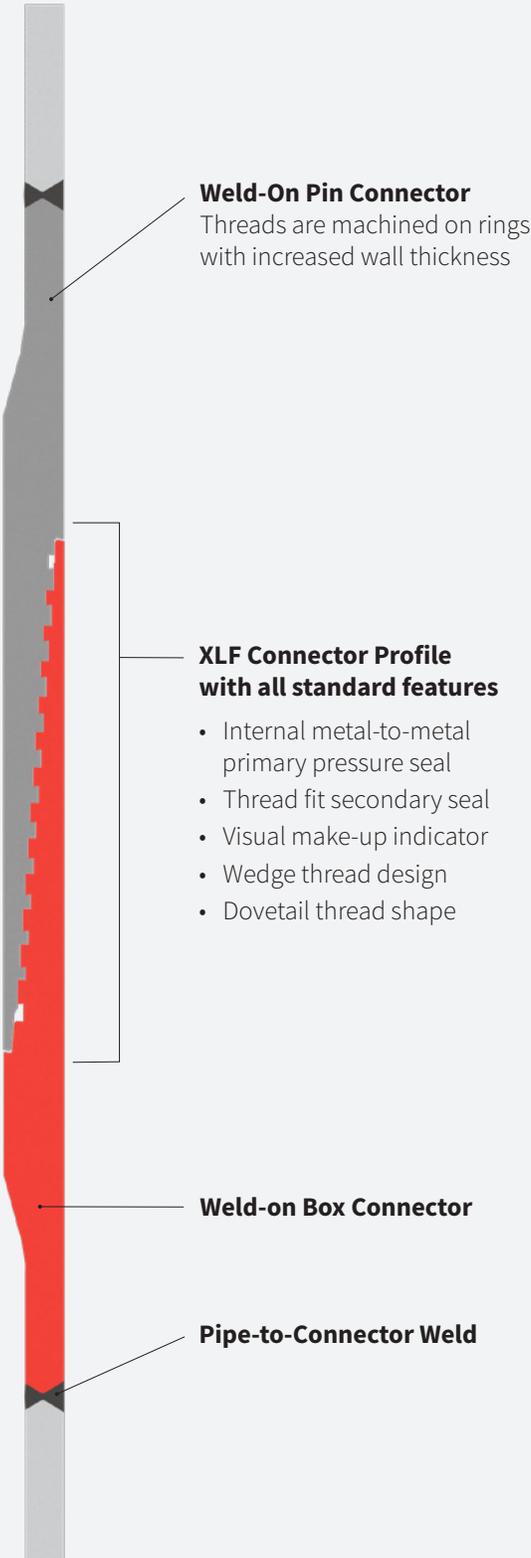
XLF-RB connectors make-up in approximately 3 turns from stab to full make-up and do not require a mechanical anti-rotation device to prevent unintended connector back-off.

Weld-On Pin and Box Connectors

True Flush OD Connector Profile



Reduced ID Bore Connector Profile



Weld-On Pin Connector
 Threads are machined on rings with increased wall thickness

XLF Connector Profile with all standard features

- Internal metal-to-metal primary pressure seal
- Thread fit secondary seal
- Visual make-up indicator
- Wedge thread design
- Dovetail thread shape

Weld-on Box Connector

Pipe-to-Connector Weld

XLF-HS Connectors

20- to 48-inch Sizes

Illustrations on this page show the weld-on XLF-HS (high-strength) connector configuration. Standard XLF 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.

XLF-HS connectors are intended for use in deviated strings or other heavily loaded surface casing string applications where flush OD and flush ID connector profiles are desired and where integral-threaded XLF connector strength ratings do not meet design criteria. Several standard forging grade options are available to match XLF-HS connector strength ratings to project design criteria.

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

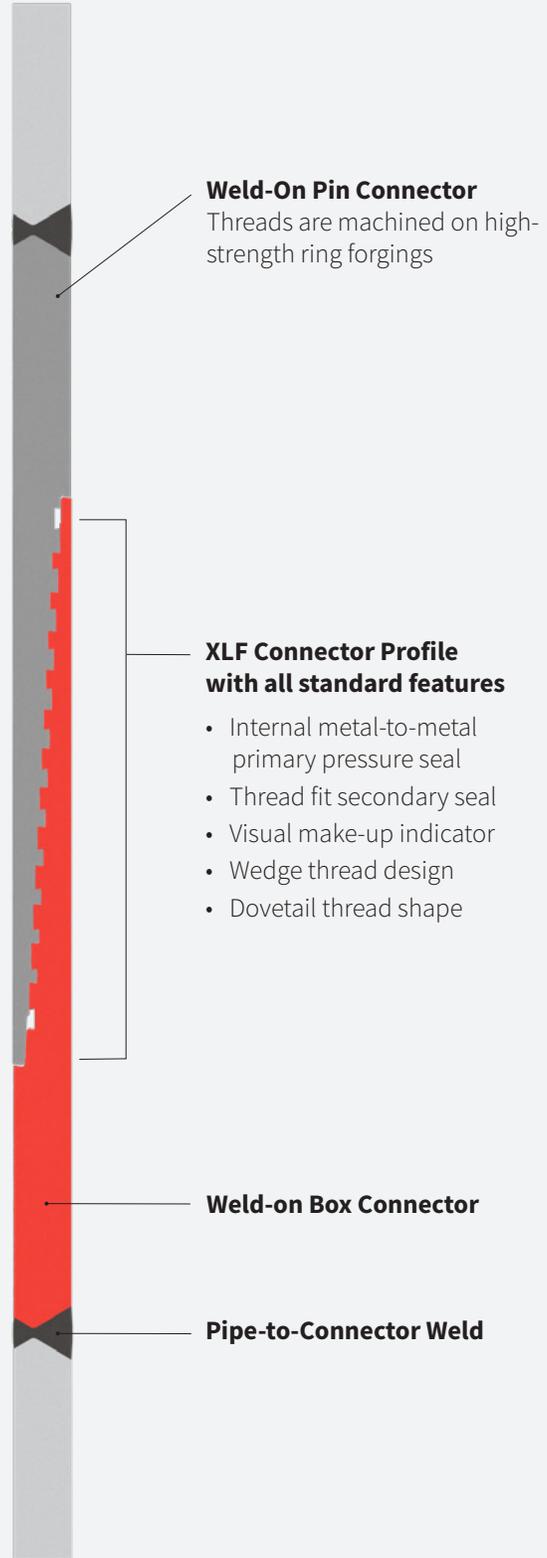
XLF-HS connectors make-up in approximately 3 turns from stab to full make-up and do not require a mechanical anti-rotation device to prevent unintended connector back-off.

Weld-On Pin and Box Connectors

True Flush OD Connector Profile



True Flush ID Connector Profile



Weld-On Pin Connector
Threads are machined on high-strength ring forgings

XLF Connector Profile with all standard features

- Internal metal-to-metal primary pressure seal
- Thread fit secondary seal
- Visual make-up indicator
- Wedge thread design
- Dovetail thread shape

Weld-on Box Connector

Pipe-to-Connector Weld



PDL Subs

A common method of running and handling pipe with flush-profile XLF, XLF-RB, and XLF 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 XLF 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. It is noted that XLF connectors are rarely used in driven conductor applications since the introduction of XL Systems second-generation XLC-S connector, a structural connector specifically designed for drive pipe applications.

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.

XLF Connectors

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

XLF connectors are integral-threaded directly on the pipe body, so connector material grade is the same as the pipe grade. Weld-on rings for XLF-RB connectors are manufactured to either API 5L pipe grade requirements or XL Systems ring forging specifications. Weld-on ring forgings for XLF-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	XLF Connector Grade	XLF-RB Connector Grade Options	XLF-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 XLF, XLF-RB, and XLF-HS connectors:

- FSPXL0007** Wedge thread connector storage, inspection, and repair
- FSPXL0010** XLF connector field service procedure
- FSPXL0019** Approved thread compounds