ROD-KNUCKLE™ ENVIRONMENTAL BOP STUFFING BOX

Through extensive research and comprehensive field testing, Nelgar Oilfield Services Ltd. has designed a patented **Rod-Knuckle™ Environmental BOP Stuffing Box**.

The **Rod-Knuckle™** features the following advantages over other major competitors'.

Features	Benefits
Dual packing	Superior environmental protection - the top (secondary) packing provides a positive seal when the bottom (primary) packing fails.
Self-aligning knuckle	Reduce side loading on top packing - the top packing rotates with the polished rod when a misalignment exists.
Check valve	Prevent costly blowouts – specially constructed for exceptional strength, the check valve closes in the event of a polished rod failure and provides a reliable shut-off.
Optional pressure shut-down switch	Early detection of bottom packing failure – utilize control chamber pressure resulting from a bottom (primary) packing failure.
Optional lubrication systems	Prolong packing life - self contained Knuckle Buddy and Swedge lubrication systems.
Quick and easy maintenance (easiest in industry)	Reduce expenses and save time – wearable parts can be easily replaced without lifting any components of the Rod-Knuckle™ over the polished rod.
Low profile, light weight and rugged	Build to last, easy to install and maintain. **"NOT YOUR WEAK LINK"**

The **Rod-Knuckle™ Environmental BOP Stuffing Box** is tested to 10,500 psi. It withstands 42,000 lbs top load without crushing the top and bottom packing. The check valves are specially constructed for exceptional strength. Its unique **knuckle** design allows the top (secondary) packing to rotate with the polished rod when a misalignment exists. The **Rod-Knuckle™** can also be utilized as an alignment tool. It is suitable for regular, sour and high temperature services.

The **Rod-Knuckle™** is a cost effective and durable wellhead accessory designed to protect and preserve the environment. Its operation is simple and reliable.

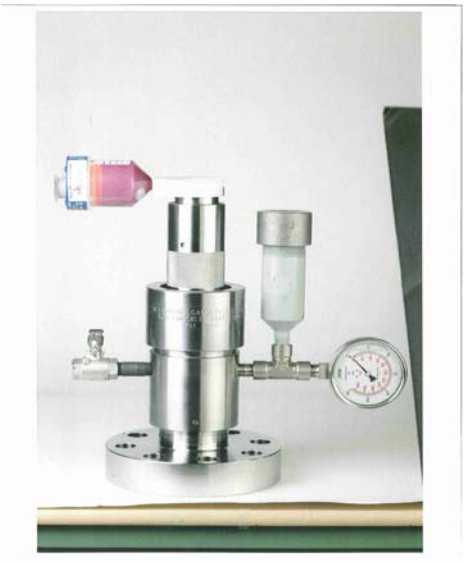
SPECIFICATIONS

Size	polished rod:	1-1/2", 1-1/4"
	flow tee connection:	2-3/8" EUE, 2-7/8" EUE, 3-1/2" EUE, 3" API line pipe
	flange connection:	R27
Pressure (psi)		3,000 (tested to 10,500 psi)
Top load (lbs)		42,000 maximum (without crushing top and bottom packing)
Operating Temperature (°F)		-50 and up
Dimensions		16.5"H x 5.5"OD
Weight		45 lbs
Material	body	4140 HTSR steel (heat treated stress relief)
	check valve	regular services – Delrin® 511P NC010 acetal resin sour services – Delrin® 511P NC010 acetal resin high temperature services – 6061-T6 aluminum (solution heat treated and artificially aged) sour high temperature services – PEEK™ polymer
	brass rings	ASTM B505-08
	packing	available for different services and applications

* Exceeded PSAC IRP Minimum Wellhead Requirements

** Passed ASTM A370 Standard Test for Mechanical Testing of Steel Products

Flow Tee Connection Model



Flange Connection Model

Rod Knuckle™ Components

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Two places to use spanner wrench for access to the packing.

Two thumb screws must also be loosened for access to the packing. They must be re-tightened after each service. (finger-tight only)

Set-screw is used to secure knuckle

Threaded Packing Gland With Bronze Insert

Top (secondary) Packing

Top Split Ring Packing Retainer

Knuckle Nut

Knuckle

Top Brass Ring

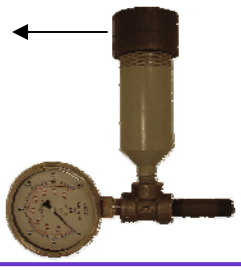
Bottom Brass Ring with O-Ring

Floating Check Valve Seat with O-Ring

Oil Chamber

Pressure Gauge

Integral Control Chamber



Pressure Relief Valve

Top View of Control Chamber with Check Valve Inserted

Bottom Packing Gland Ring

Bottom Split Ring Packing Retainer

Bottom (primary) Packing

Bottom Split Ring Packing Retainer

Flow Tee Adapter with O-Ring

R27 Flange with O-Ring

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INDUSTRY AT A GLANCE

Feature	Nelgar **Rod-Knuckle™**	Red Wing Super B7	Opal HF	Dura PCCV	Hercules PCSB	Production Safety HT
Dual packing	√	√	√	√	√	X
Different packing required	X (same for both)	X	√ (2 different types)	√ (2 different types)	√ (3 different types)	N/A
Top load crushes packing	X	X	√	X	√	X
Rotating top packing and side loading relief	√	X	X	X	X	X
Integral BOP (check valve incorporated)	√ (1 piece)	√ (1 piece)	3 pieces (sold separately)	2 pieces (sold separately)	Add-on required (sold separately)	√ (1 piece)
Check valve causes damage to polished rod	X	√	√	√	√	√
Rated pressure (psi) Testing pressure (psi)	3,000 10,500	2,500 5,000	2,500 4,000	2,000 4,000	1,500 N/A	3,000 N/A
Operating temperature (°F)	-50 and up	-40 and up	-15 and up	-15 and up	-15 and up	-40 and up
Pressure shut-down switch	√	√	X	√	X	X
Lubrication systems	√	X	X	X	X	X
Easy access to check valve and change parts	√	X	X	X	X	X
Height (in)	16.5	20.4	24.5	25	33	12
Weight (lbs)	45	85	70	65	112	45
Main body material	4140 HTSR** steel	4140 steel	ductile* steel	ductile* steel	ductile* iron	4140 steel

* PSAC IRP 5.2.4 – Wellhead equipment manufactured from ductile iron is not suitable for use in western Canada when exposed to extremely low ambient temperatures.

** HTSR - heat treated stress relief