# Shear Ram Product Line

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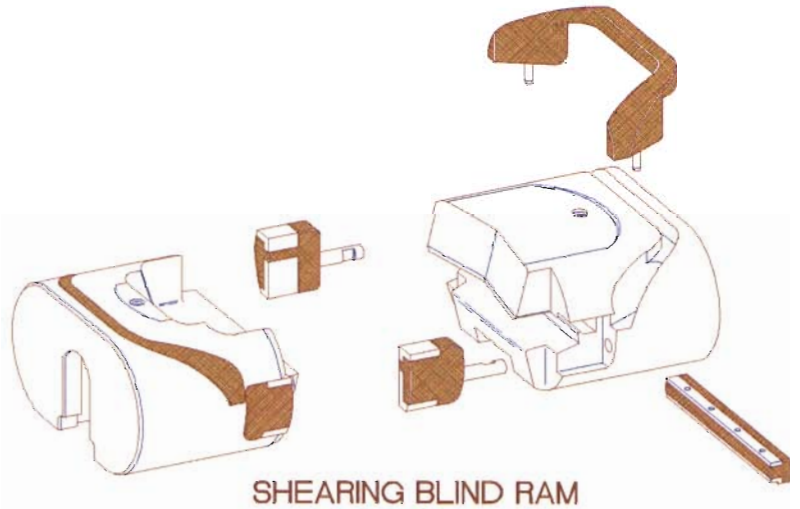
## ***Shearing Blind Rams (SBRs)***

Standard SBRs are "Single-Piece" shear rams with the blades integral to the ram body. SBRs were introduced to replace the Model III Shear Rams (now obsolete), which had bolt-on blades. The upper SBR features a 'V' shaped cutting edge while the lower SBR has a straight cutting edge. The upper SBR houses a large blade packer which seals on the front surface of the lower SBR blade.

Shearing Action: Upon completion of shearing, the lower fish is folded over and flattened to allow the front surface of the lower blade to seal against a blade packer.

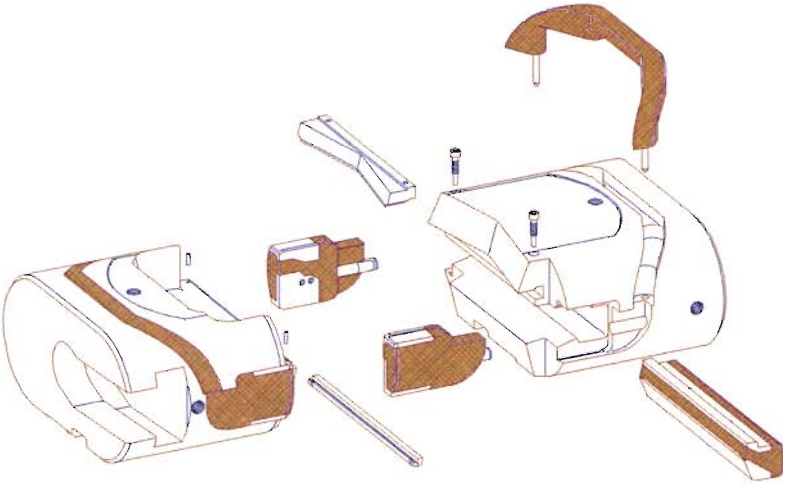


SHEARING BLIND RAM

## *$H_2S$ Shearing Blind Rams ($H_2S$ SBRs)*

$H_2S$ SBRs are similar in design to the standard SBRs with the exception of the shear blades. $H_2S$ SBRs feature blade inserts of hardened high alloy material suitable for $H_2S$ service.

Shearing Action: Upon completion of shearing, the lower fish is folded over and flattened to allow the front surface of the lower blade to seal against a blade packer.



H2S SHEARING BLIND RAM

## *Dual String (DS) Shear Rams*

DS Shear Rams were developed to shear multiple tubing strings regardless of their orientation to the centerline of the ram bore. In addition to this capability, the 'DS' shear rams can shear larger diameter tubulars than

the standard SBRs due to the increased blade width and thickness. An efficient shear blade geometry on both the upper and lower rams serves to reduce the required shearing force.
These increased capabilities required the use of a sealing mechanism that sacrifices fatigue life compared to that of the SBRs.

The DS can shear heavier, larger pipe and is better suited for shearing multiple strings compared to the SBR for three main reasons:

1. The blades are wider, covering more of the throughbore.

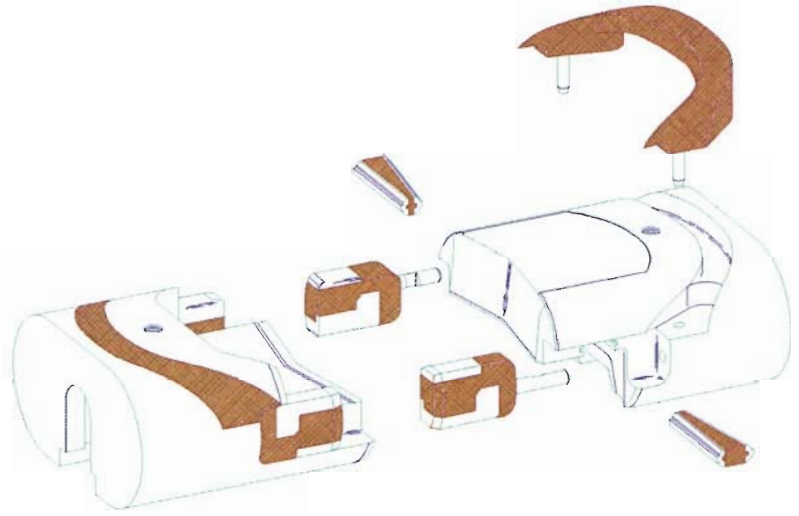
2. The fold-over shoulder has been eliminated by placing the blade seal between the blades.

3. Both blades have an efficient "V" shape.

While these features increase shearing capability, they reduce the performance of the DS as a blind ram. The wider blade dictates narrower side packers, and the seal between the blades cannot be energized directly by ram closure. This must be accomplished by feeding rubber from the side packers into the blade seal slot. This means that the sealing system of the DS is less robust than that of the SBR and the packer service life is shorter.

Cameron fatigue tests shear rams to help predict service life when used as a blind ram. A typical test cycle consists of seven open and close functions followed by a pressure test to working pressure. The DS survives six or seven cycles in this test. We therefore recommend that closures and pressure tests of the DS rams be held to a minimum consistent with safety and regulatory compliance.

Shearing Action: Upon completion of shearing, the lower fish is housed in a vertical pocket while the blade face seal provides a seal between the horizontal faces of the upper and lower blades.

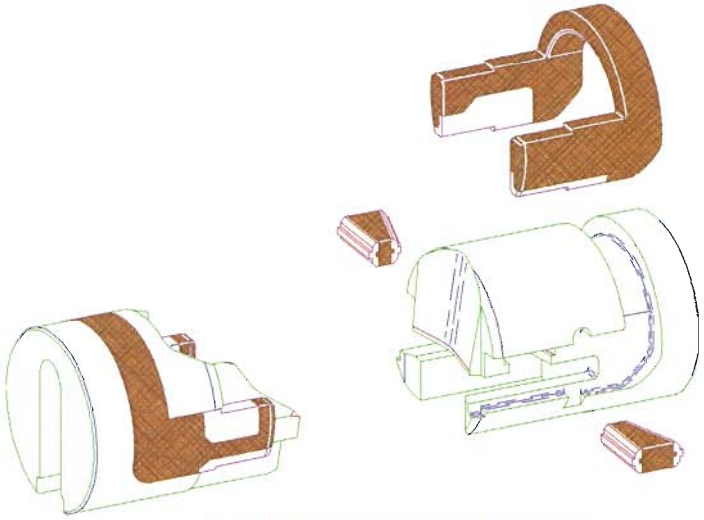


DS SHEARING BLIND RAM

## *Dual String Interlocking (DSI) Shear Rams*

DSI Shear Rams are similar in design to the standard DS shear rams except for the interlocking feature of the rams. Pockets in the lower ram and arms on the upper are used to prevent any vertical separation between the lower and upper blades. The interlocking feature provides the capability to shear wireline and braided cable with zero tension in the line and still maintain a seal. In doing this, some of the blade width is lost, thus losing the ability to shear larger diameter pipe and casing.

Shearing Action: Same as the DS rams except that when the rams first engage, any separation between the blades is eliminated.

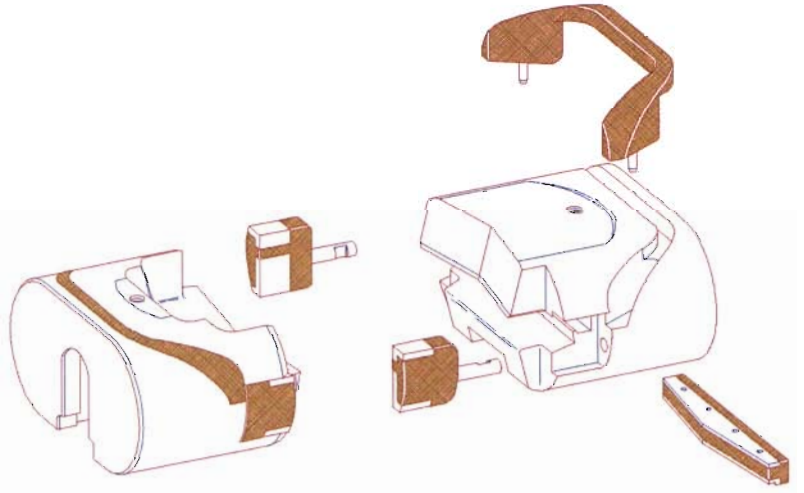


DSI SHEARING BLIND RAM

## *Double 'V' Shear (DVS) Rams*

DVS Rams combine the features of the SBR and DS rams into one shear ram. Both the upper and lower DVS rams feature a 'V' shaped cutting edge to reduce the required shear force. The blade widths are maximized to increase the shearing capabilities. The upper DVS houses a large blade packer which seals on the front edge of the lower DVS blade.

Shearing Action: Upon completion of shearing, the lower fish is folded over and flattened to allow the leading edge of the lower blade to seal against a blade packer.

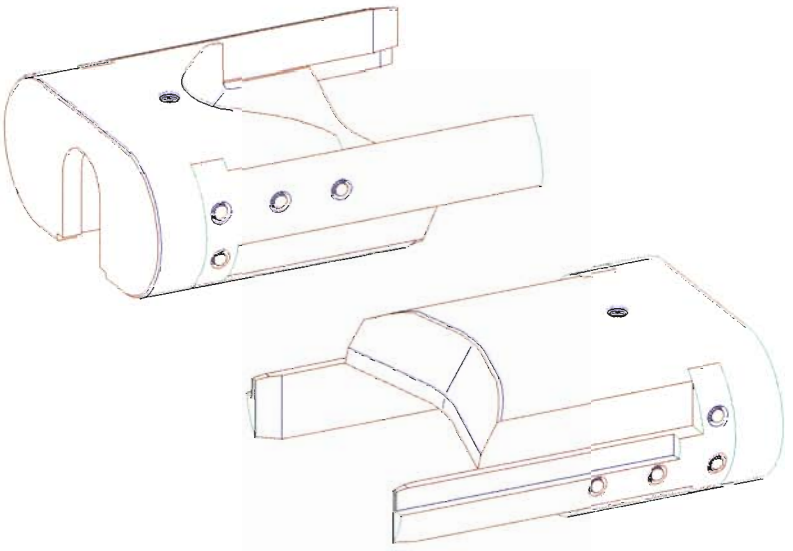


DVS SHEARING BLIND RAM

## *Super Shear Rams (SSRs)*

The SS Rams were developed to shear drill collars and large diameter casing. These rams are also capable of shearing heavy wall drill pipe and tool joints. The SS rams are non-sealing rams.

Shearing Action: Arms which are integral to the ram bodies extend out along the sides of the ram bore to keep the shear blades properly engaged and to prevent the width of the sheared fish from exceeding the vertical bore diameter. Upon completion of shearing, the lower fish is housed in a vertical pocket.

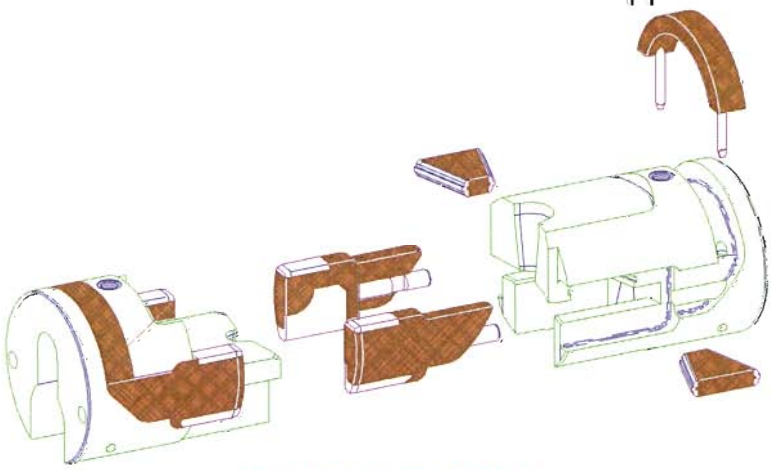


SUPER SHEAR RAMS

## *Tubing Shear Rams (TSRs)*

The TSRs are designed to shear a limited range of coiled or standard tubing. Both the upper and lower blades feature a conical shearing pocket. Upon shearing, the final outside diameter of the tubing is equal to or less than its original outside diameter. This eliminates the need for an additional trip downhole to mill off a prep before running an overshot tool. A minimum of 30% of the original flow area through the tubing is maintained after shearing. The TSRs feature a blade face seal similar to the 'DS' shear rams. Interlocking blades also provide the ability to shear wireline and braided cable with zero tension in the line.

Shearing Action: Any gap between the upper and lower blades is eliminated as the rams first engage. Upon completion of shearing, the conical pocket in the upper ram mates with the conical cutting edge of the lower ram to shape the lower fish into a diameter less than or equal to the original O.D. The lower fish is housed in a vertical pocket, while the blade face seal provides a seal between the horizontal faces of the upper and lower blades.

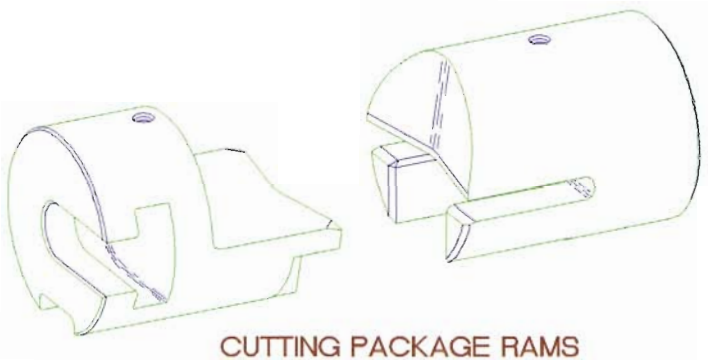


TUBING SHEAR RAM

## *Cutting Package (CP) Rams*

Cutting Package Rams are designed for use in completion or workover operations. CP rams feature a 'V' geometry on both the upper and lower rams. These rams are capable of shearing tubing and solid sinker bars. CP rams are non-sealing rams.

Shearing Action: Upon completion of shearing, the lower fish is housed in a vertical pocket.



CUTTING PACKAGE RAMS

## *Large Bore Shear Bonnets*

In order to increase the available shear force for a U BOP, large bore shear bonnets were developed. Large bore shear bonnets increase the available closing area by 35% or more. Between June 1981 and June 1982 large bore shear bonnets became the standard offered on the 11" and 13-5/8" 3,000, 5,000, 10,000 and 15,000 psi BOPs,
16-3/4" 5,000 and 10,000 psi BOPs, 20-3/4" 3,000 psi BOPs, and
21-1/4" 2,000 psi BOPs.
(Cameron EB 571 D)

## *Tandem Boosters*

In order to increase the available shear force for a BOP, tandem boosters were developed. The tandem booster features a two-part piston designed to disengage after shearing, but prior to energizing the packers. This allows for increased shear forces without additional wear on the packers. Tandem boosters are standard for the 7-1/16" 3,000, 5,000, 10,000, and 15,000 psi U BOPs. (COT EB 685 D)

## *Model III Shear Rams* OBSOLETE!!!

All Cameron Model III Shear Rams were declared OBSOLETE in July 1982. Model IIIs featured bolt-on upper and lower blades and a blade face seal. These rams are no longer available. They have been replaced by the SBRs.

Shearing Action: Upon completion of shearing, the lower fish is housed in a vertical pocket while the blade face seal provides a seal between the horizontal faces of the upper and lower blades.

# Shear Ram Comparison Table

| RAMS | Range of Shearing Capabilities | Lower Blade Geometry | Upper Blade Geometry | Sealing Mechanism | Current BOP Availability |
|---|---|---|---|---|---|
| SBRs | Tubing, Drill Pipe, Small Casing | Straight | 'V' | Blade Packer | U, U II, T, G-2 |
| $H_2S$ SBRs | Tubing, Drill Pipe, Small Casing | Straight | 'V' | Blade Packer | U, U II, T |
| DS | Sinker Bar, Single/Multiple String, Tubing, Drill Pipe, Small Casing | 'V' | 'V' | Blade Face Seal | U |
| DSI | Wireline, Cable, Sinker Bar, Drill Pipe Single/Multiple String, Tubing | 'V' | 'V' | Blade Face Seal | U, G-2 |
| DVS | Tubing, Drill Pipe, Small Casing | 'V' | 'V' | Blade Packer | U, TL |
| SSRs | Drill Collars, Heavy wall Drill Pipe, Tool Joints, Large Casing | 'V' | 'V' | Non-Sealing | U, TL |
| TSR | Wireline, Cable, Tubing | Conical | Conical | Blade Face Seal | U, SWIB |
| CP | Sinker Bar, Tubing | 'V' | 'V' | Non-Sealing | G-2, S/QRC, CP |

# Shear Ram Comparisons

## SBRs -vs- DS

Shearing Blind Rams

- Longer packer fatigue life

Dual String Shear Rams

- Require less shear force
- Capable of shearing larger diameters
- Capable of shearing multiple tubulars
- Shorter packer fatigue life

## SBRs -vs- $H_2S$ SBRs

Shearing Blind Rams

- Suitable for sour service per NACE MR-0175
- Integral shear blades

$H_2S$ Shearing Blind Rams

- Suitable for sour service per NACE MR-0175
- Replaceable blade inserts

## SBRs -vs- DSI

Shearing Blind Rams

- Longer packer fatigue life

DS Interlocking Shear Rams

- Require less shear force
- Capable of shearing wireline and braided cable with zero tension
- Capable of shearing solid sinker bars

## SBRs -vs- DVS

Shearing Blind Rams

- Longer packer fatigue life

Double 'V' Shear Rams

- Require less shear force
- Capable of shearing larger diameters
- No loss of fatigue life

## DS -vs- DSI

DS Shear Rams

- Capable of shearing larger diameters
- Capable of shearing multiple tubing strings

DS Interlocking Shear Rams

- Capable of shearing wireline and braided cable with zero tension
- Capable of shearing solid sinker bars

## DS -vs- DVS

Dual String Shear Rams

- Capable of shearing solid sinker bar
- Shorter Packer Fatigue Life

Double 'V' Shear Rams

- Longer packer fatigue life

# GENERAL INFORMATION FROM NACE MR0175-97

"Section

## 11.4.2 Blowout Preventer Shear Blades

11.4.2.1 High-strength and high-hardness steels are required for ram shear blades to shear drill pipe during drilling emergency conditions. However, the user shall be advised that these materials are highly susceptible to SSC."

| | | |
|---|---|---|
| NACE | = | National Association of Corrosion Engineers |
| MR0175 | = | "Sulfide Stress Cracking Resistant Metallic Materials for Oilfield Equipment" |
| Sulfide Stress Cracking (SSC) | = | Brittle failure by cracking under the combined action of tensile stress and corrosion in the presence of water and hydrogen sulfide. |

## SHEAR RAM INFORMATION FROM API 16A

*"Specification for Drill Through Equipment"*
Second Edition

"Section IV E8.7

8.7.4 **Shear-Blind Rams**

8.7.4.1 Each blowout preventer equipped with shear-blind rams shall be subjected to a shearing test. This test requires shearing a section of 5" 19.5 ppf Grade E drill pipe for 11" bore preventers and 19.5 Grade G for 13-5/8" bore and larger preventers and sealing in a single operation. The piston closure pressure shall not exceed the hydraulic system rated working pressure."

NOTE: This section is being revised to require 7-1/16" bore BOPs to shear 3-1/2" 13.3 ppf Grade E drill pipe.

In order for Cameron to meet this requirement, the following shearing configurations are standard:

| BOP | Shear Ram | Bonnet | Tandem Booster |
|---|---|---|---|
| 7-1/16" 3-15M U | SBR | Shear Bonnet | YES |
| 11" 3-10M U | DS | Large Bore Shear Bonnet | NO |
| 11" 15M U | SBR | Large Bore Shear Bonnet | NO |
| 13-5/8" 3-10M U | DS | Large Bore Shear Bonnet | NO |
| 13-5/8" 15M U | SBR | Large Bore Shear Bonnet | NO |
| 16-3/4" 5-10M U | SBR | Large Bore Shear Bonnet | NO |
| 18-3/4" 10M U | SBR | Standard Bonnet | NO |
| 20-3/4" 3M U<br>21-1/4" 2M U | SBR | Large Bore Shear Bonnet | NO |

(Cameron EB 691 D)

# CURRENT SHEAR PRODUCT AVAILABILITY

| BOP | LARGE BORE SHEAR BONNETS | TANDEM BOOSTERS | SBR | $H_2S$ SBR | DS | DSI | DVS | SSR | TSR | CP |
|---|---|---|---|---|---|---|---|---|---|---|
| 7-1/16" 3-15M U | | YES | YES | | | YES | YES | | | |
| 11" 3-10M U | YES | YES | YES | | YES | | | | | |
| 11" 15M U | YES | YES | YES | | | | | | | |
| 13-5/8" 3-10M U | YES | YES | YES | YES | YES | | | | YES | YES |
| 13-5/8" 15M U | YES | OLD | YES | | | | | | | |
| 16-3/4" 3-10M U | YES | OLD | YES | | | | | YES | | |
| 18-3/4" 10M U | | | YES | YES | | | | | | |
| 20-3/4" 3M U | YES | YES | YES | | | | | | | |
| 21-1/4" 3M U | YES | YES | YES | | | | | | | |
| 21-1/4" 5-10M U | | | YES | | | | | | | |
| 18-3/4" 10M U II | | | YES | YES | | | | | | |
| 18-3/4" 15M U II | W/O CYL | | YES | YES | | | | | | |
| 13-5/8" 10M T | | | | YES | | | | | | |
| 18-3/4" 15M T | | | | YES | | | | | | |
| 18-3/4" 5M TL | | | | | | | YES | | | |
| 18-3/4" 10M TL | | | | | | | YES | | | |
| 18-3/4" 15M TL | SSR | YES | | YES | | | | YES | | |
| 4-1/16" 5-10M G-2 | | | YES | | | | | | | YES |
| 7-1/16" 5M G-2 | | | YES | | | YES | | | | YES |
| 4-1/16" 10-15M S/QRC | | | | | | | | | | YES |
| 4-1/16" 25M S/QRC | | | | | | | | | | YES |
| 7-1/16" 10M SWIB | | | | | | | | | YES | |
| 4-1/16" 5M C.P. | | STD | | | | | | | | YES |

# COOPER CAMERON
# SHEAR RAM PRODUCT LINE
# ENGINEERING BULLETINS

**404 D Model III Shear Rams** - Operation, Care, and Maintenance

**538 D Shearing Blind Rams** - Operation, Care, and Maintenance

**571 D Large Bore Shear Bonnets**

**648 D** Super Trim **$H_2S$ Shearing Blind Rams** to comply with NACE MR0175

**685 D Tandem Boosters** for 'U' BOPs - General Description

**691 D** Shearing Limitations due to Increased Pipe Strength **(API 16A)**

**700 D** Cameron **'DS' Shear Rams** - Operation, Care, and Maintenance

**702 D Shearing Capabilities** of Cameron Shear Rams