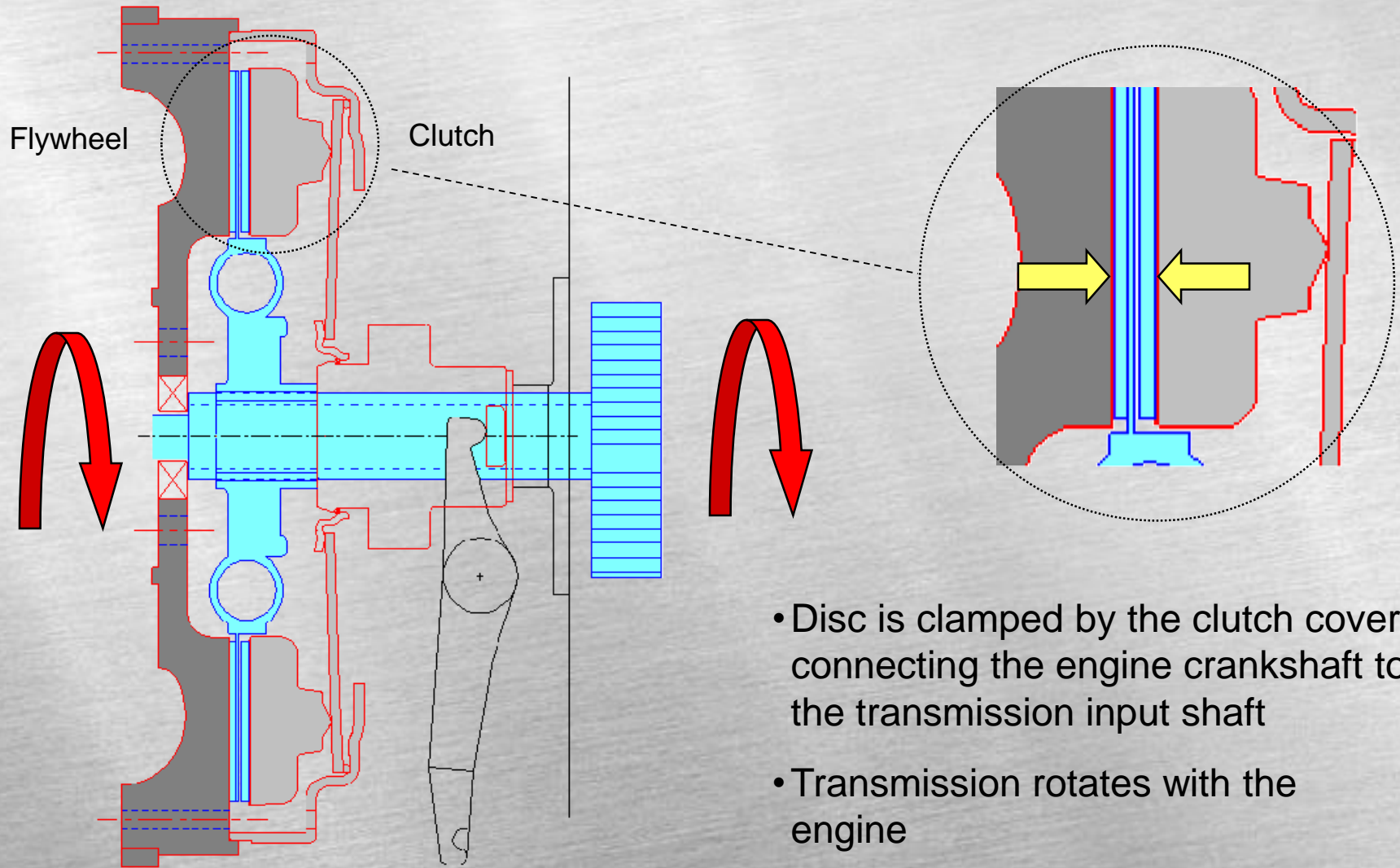


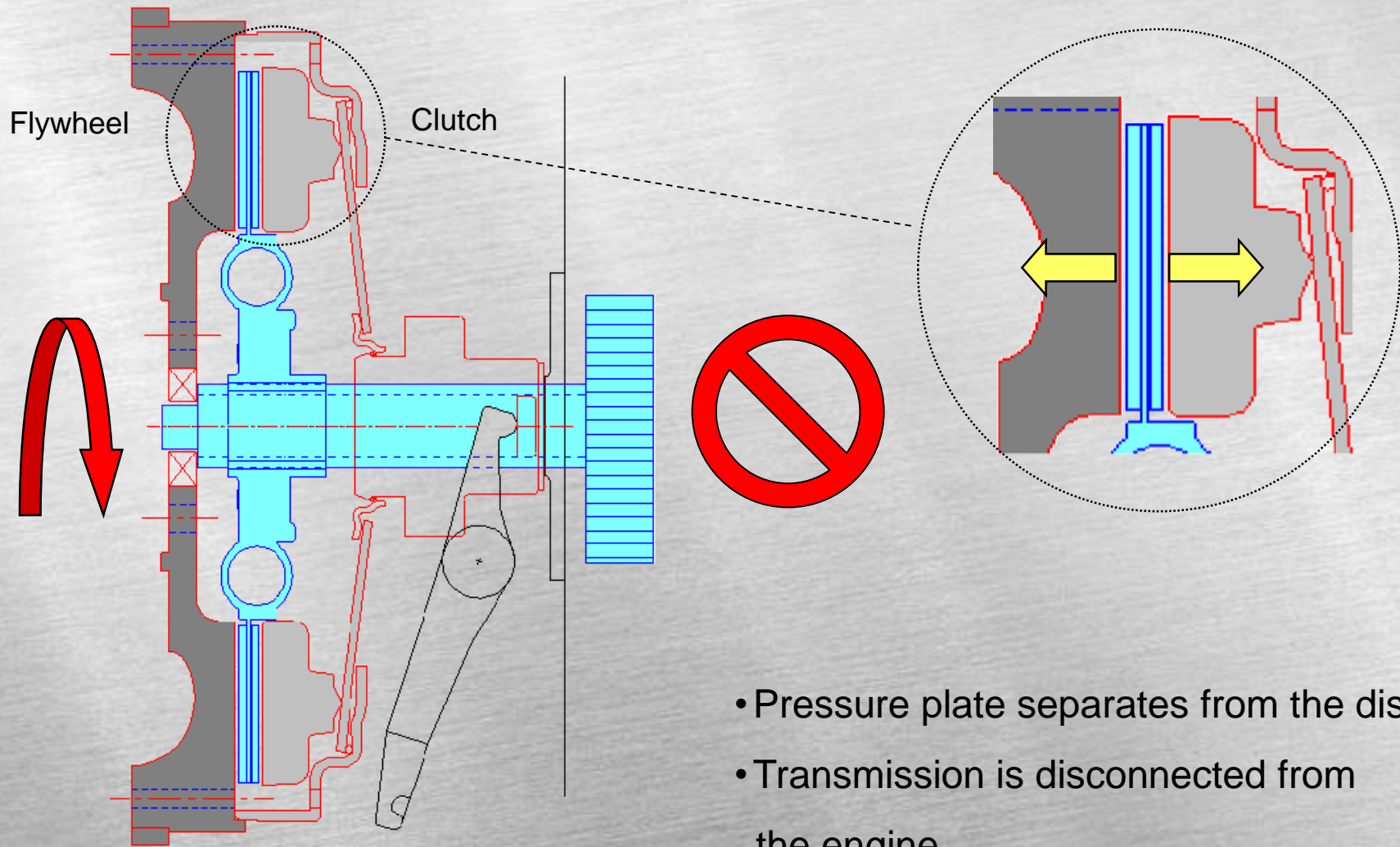
What Does a Clutch Do?

- The function of a clutch is to connect or disconnect the flow of power from the engine to the driveline
 - Provides a way to translate engine rotation into transmission rotation,
 - Provides a way to allow the engine to run without the truck moving,
 - Provides a way to break torque to select and change gears.

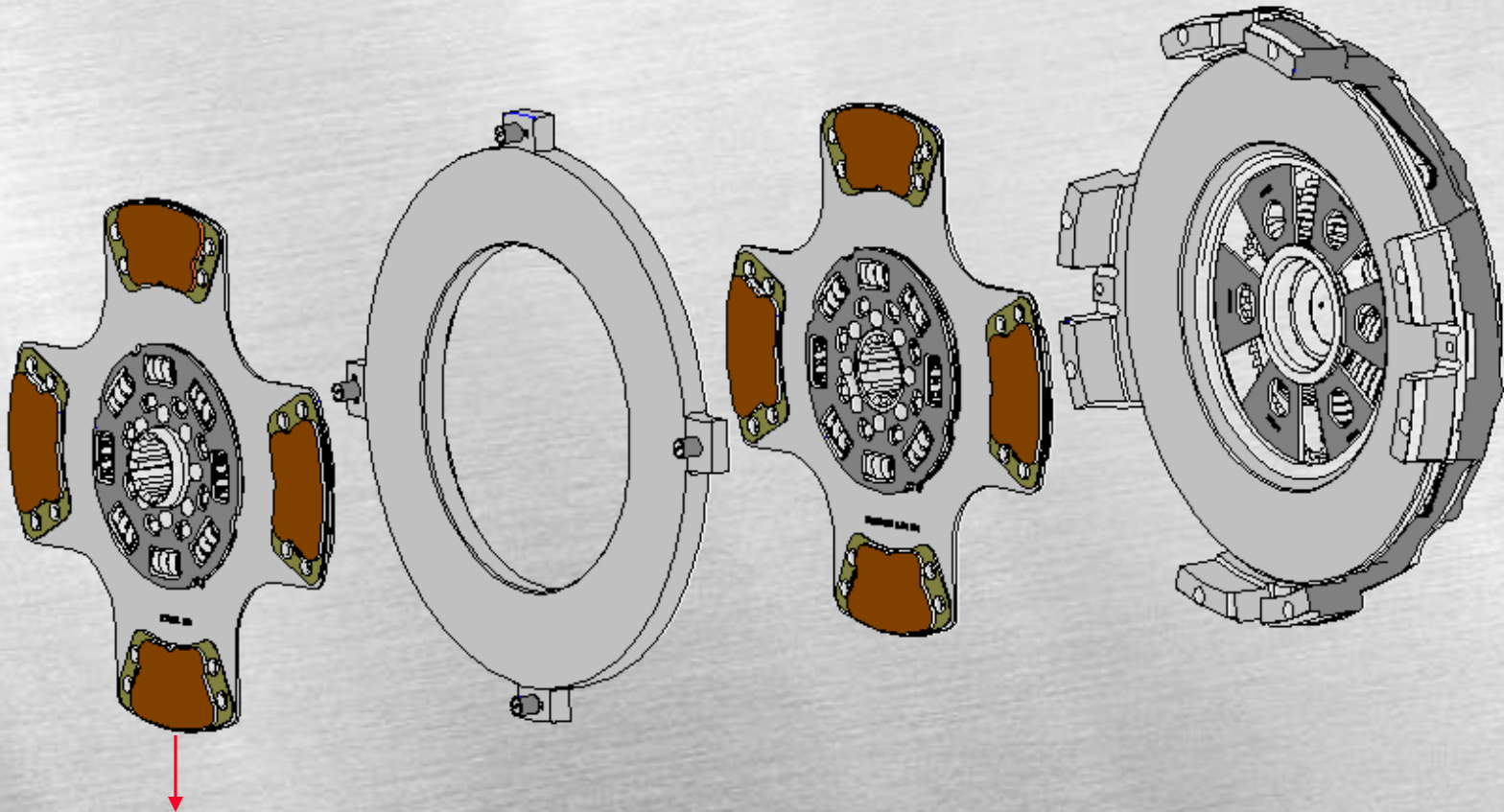
How Does it work ? - Engaged



How Does it work ? - Disengaged

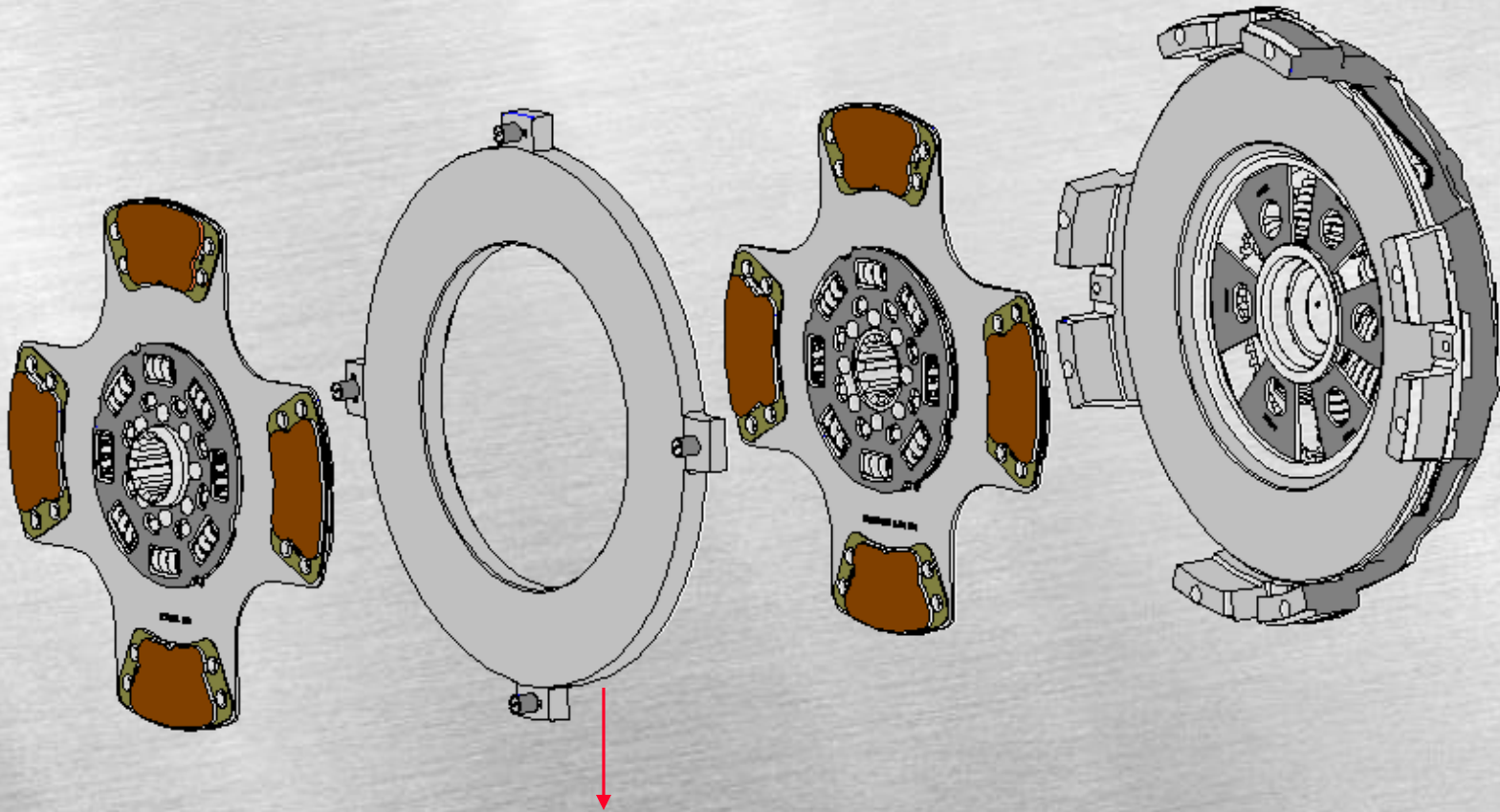


Clutch - Basic Components



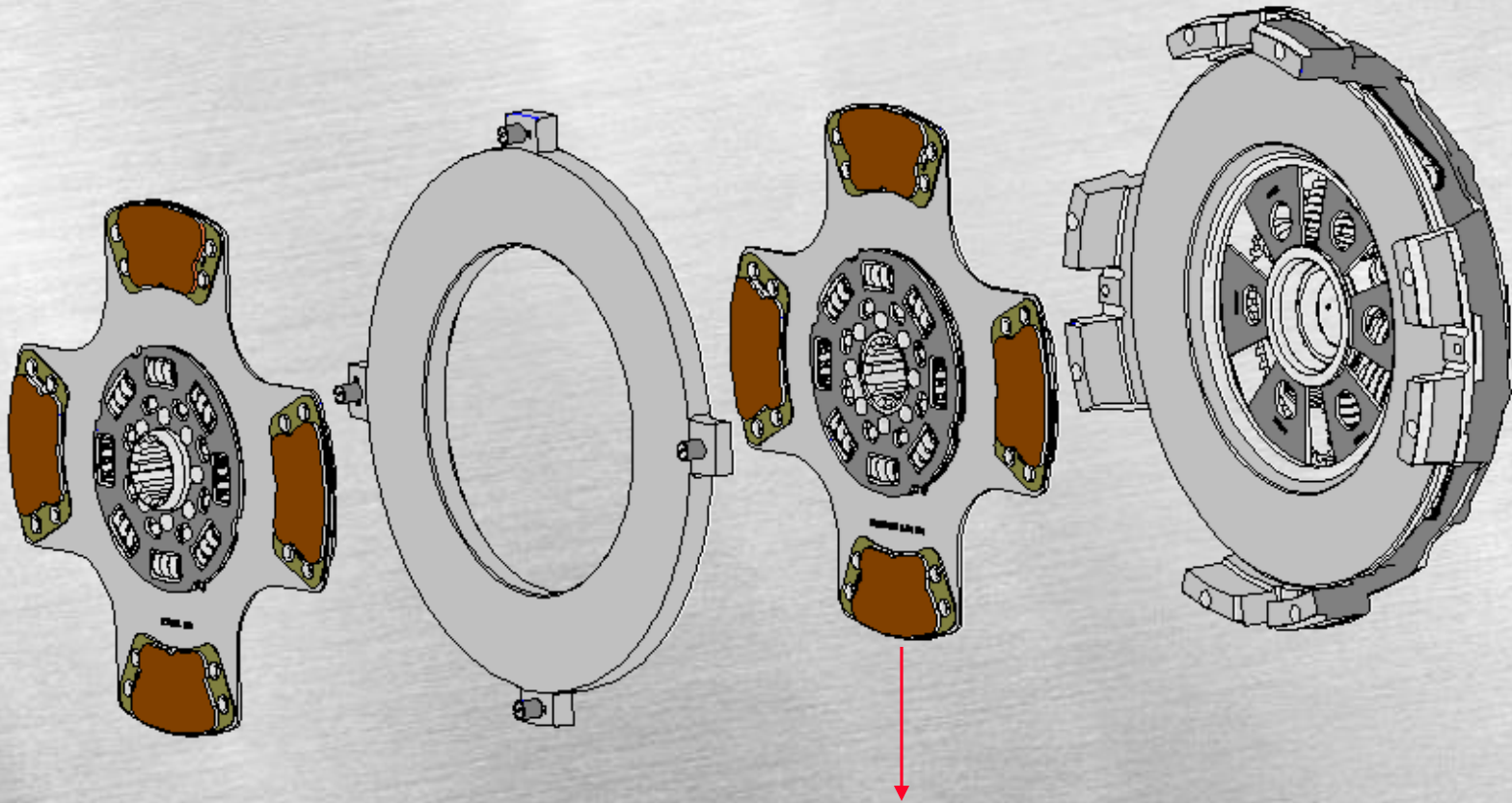
Front Disc: This is the disc which is in contact with the engine flywheel in a 2-plate clutch.

Clutch - Basic Components



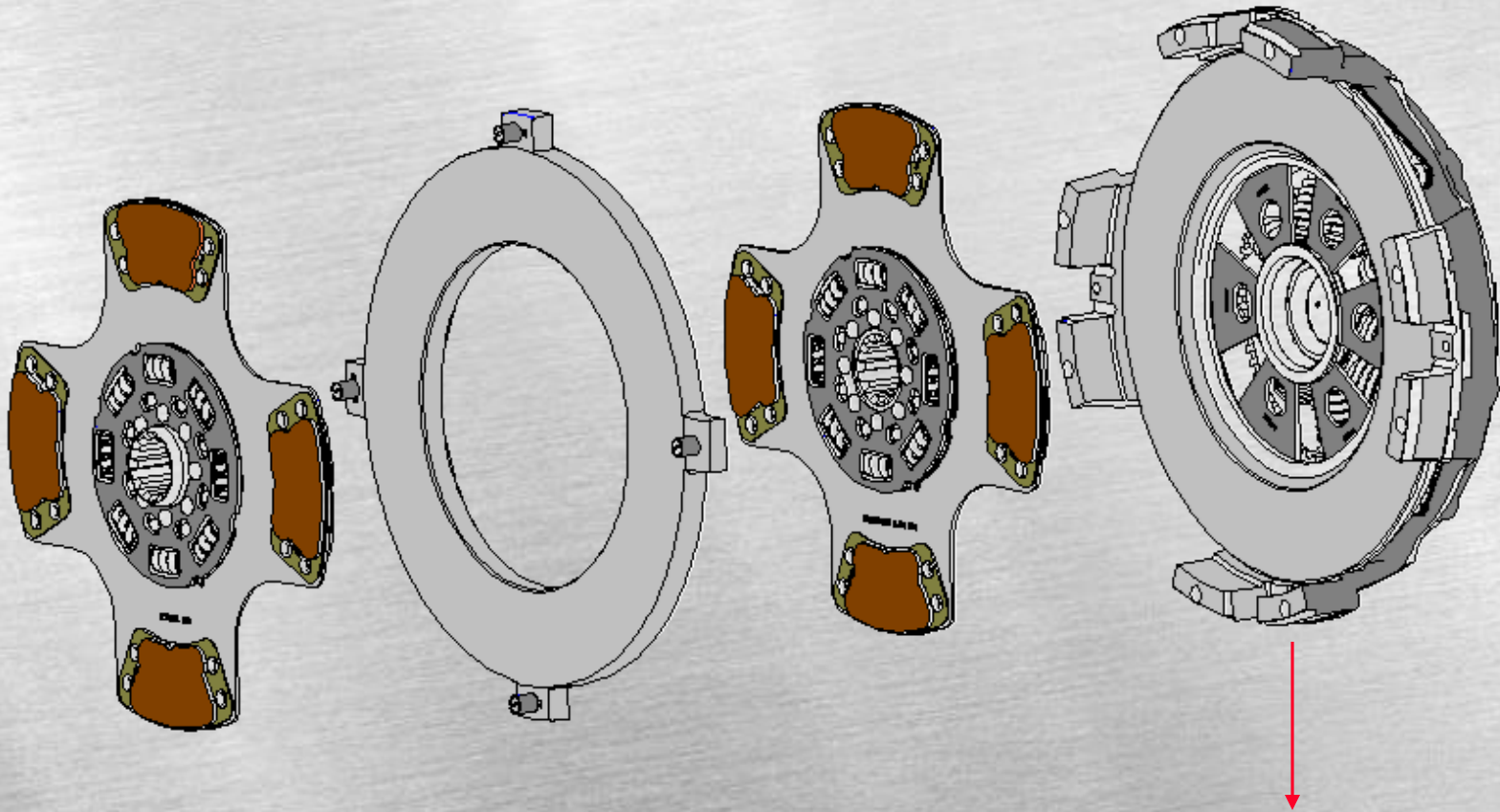
Intermediate Plate: A floating cast iron plate that provides additional clamping surfaces for the discs in a 2-plate clutch.

Clutch - Basic Components



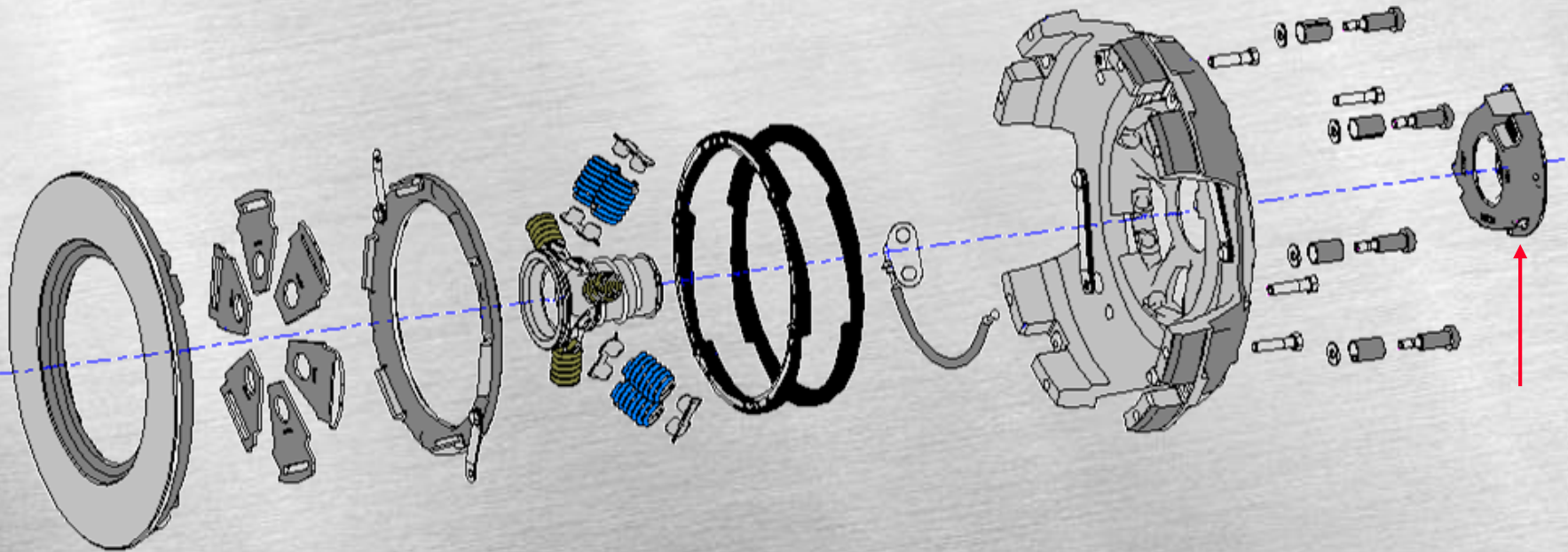
Rear Disc: This is the disc which is in contact with the cover assembly in a 2-plate clutch.

Clutch - Basic Components



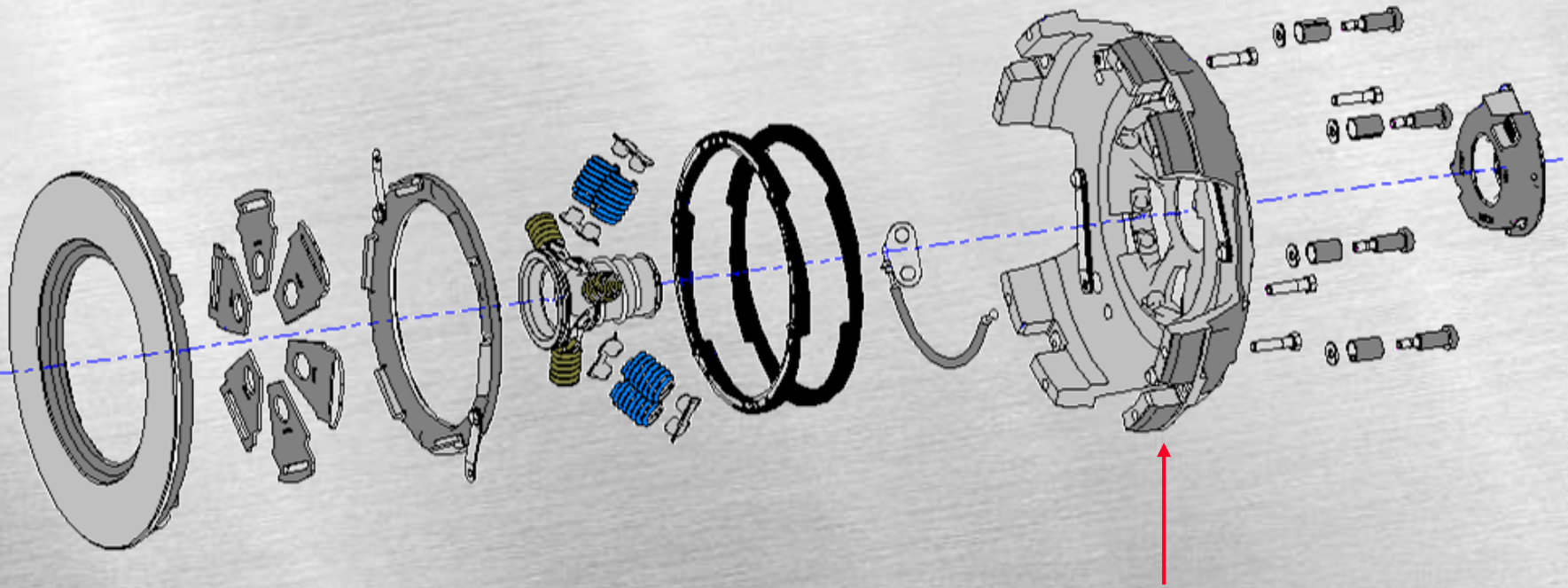
Cover Assembly: An assembly which is mounted on the flywheel, and squeezes the discs against the intermediate plate (in a 2-plate clutch) and the flywheel.

Release Bearing / Throw-out Bearing



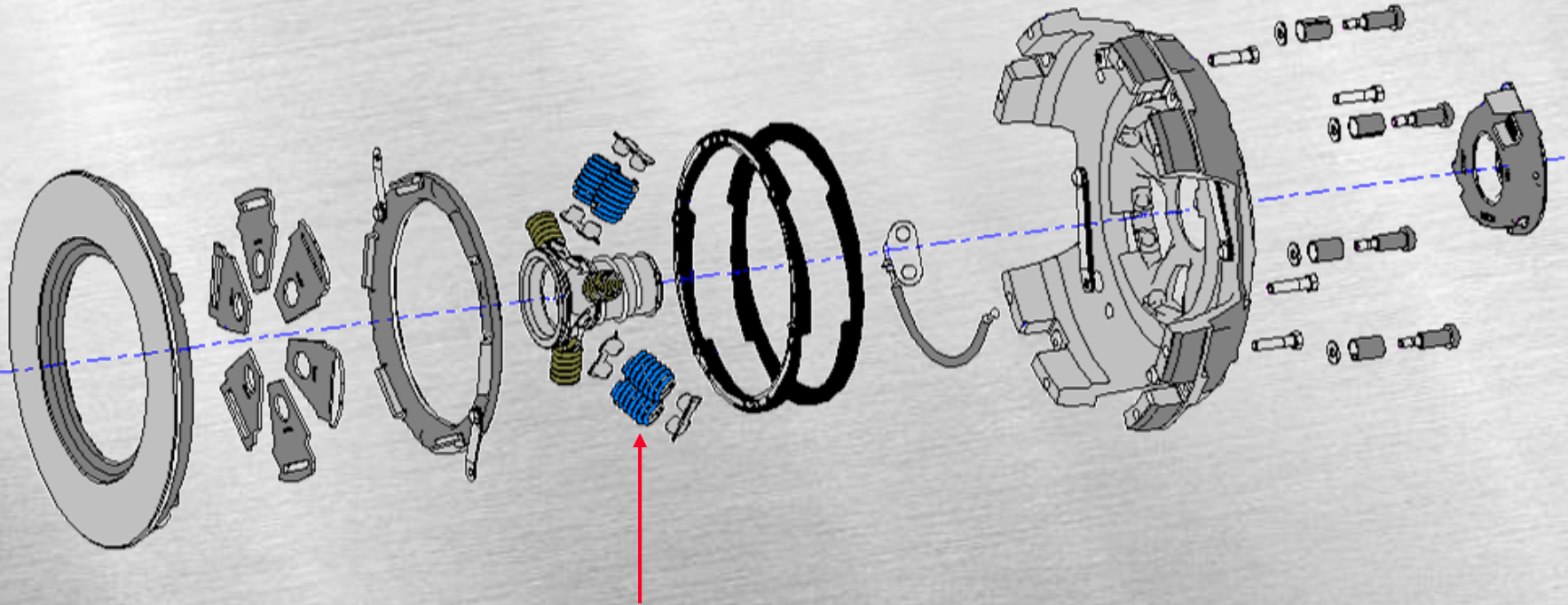
Release Bearing: Serves as a stationary connection for the release linkage. Contacts (squeezes) the clutch brake, in non-synchronized transmissions.

Flywheel Ring / Bracket / Cover



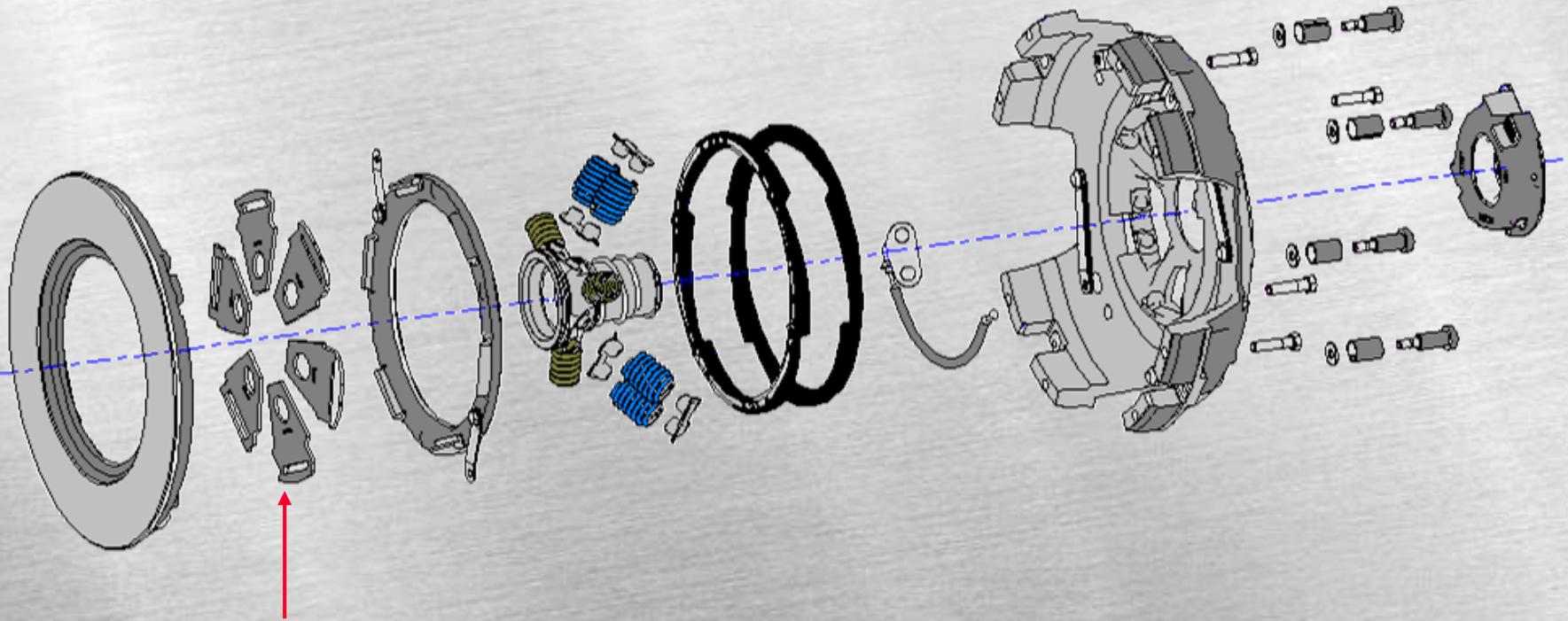
Flywheel Ring: Houses the Pressure Springs, Assist Springs, Spring Retainer, Levers, Cams (Adjusting Ring), and Pressure Plate.

Pressure Springs



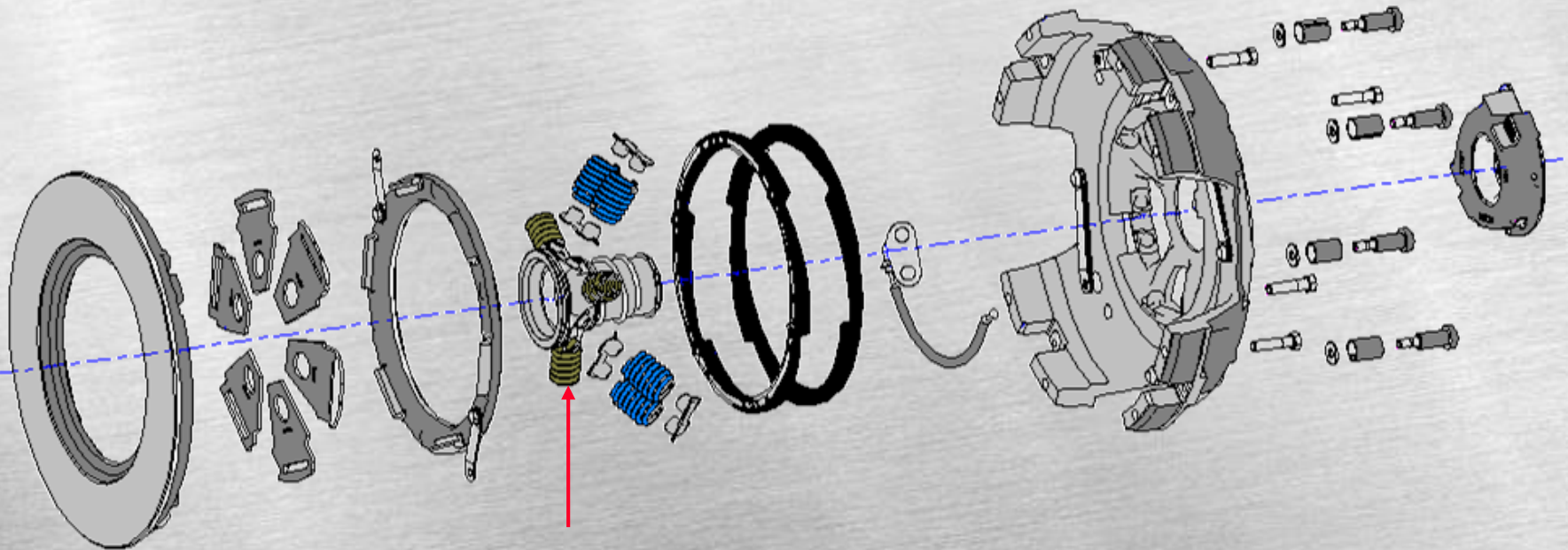
Pressure Springs: 3 pairs of coil springs provide the spring force required for developing pressure plate clamp load.

Levers



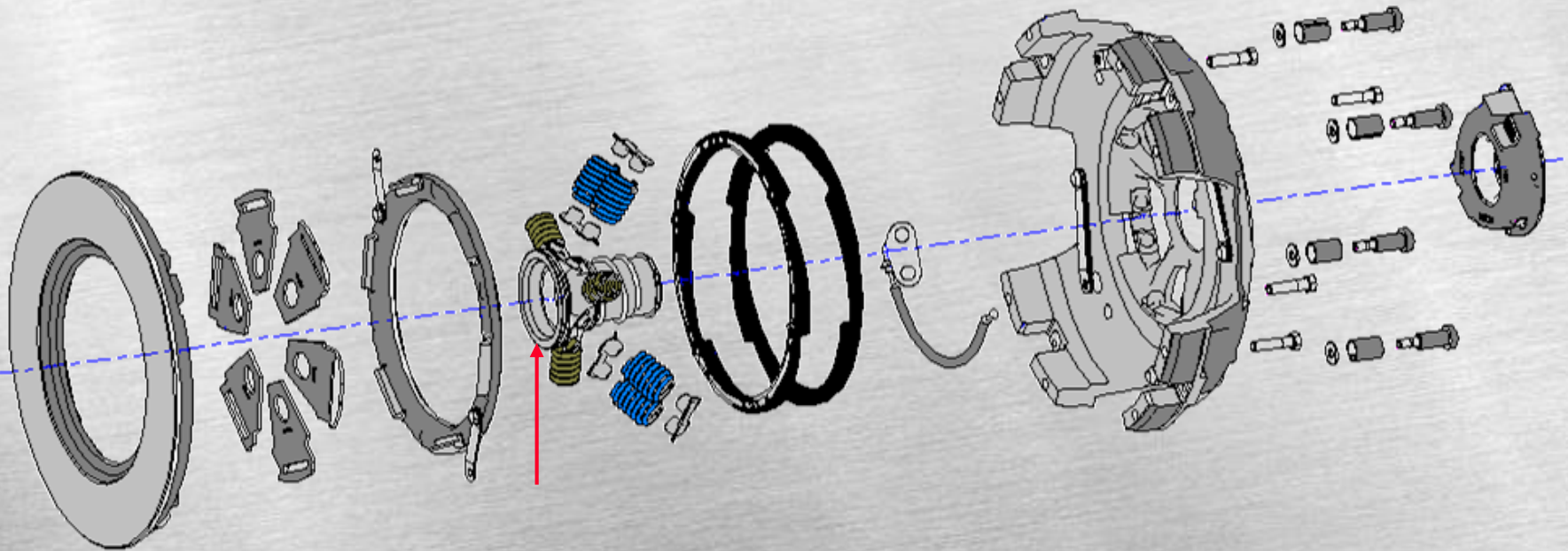
Levers: 6 levers amplify the spring force of the pressure springs to generate the desired pressure plate clamp load. Also serve as a means for clutch disengagement.

Assist Springs



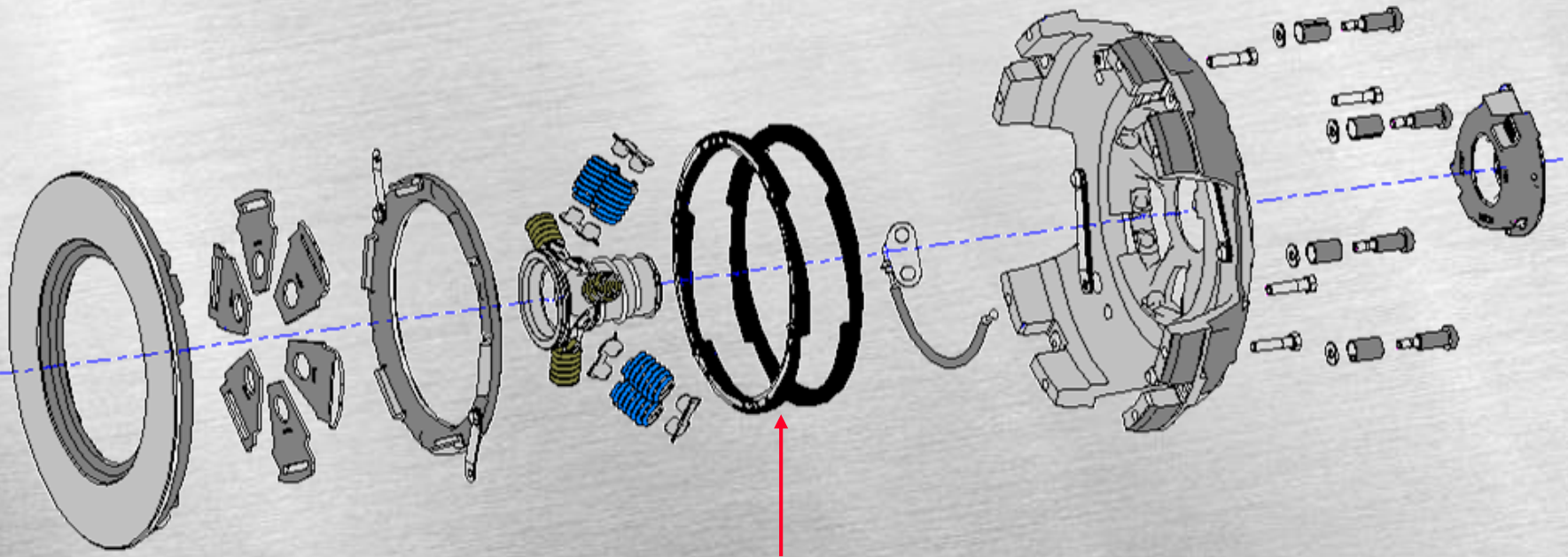
Assist Springs: 3 coil springs which help reduce clutch release load, and thereby reduce pedal effort during clutch disengagement.

Retainer



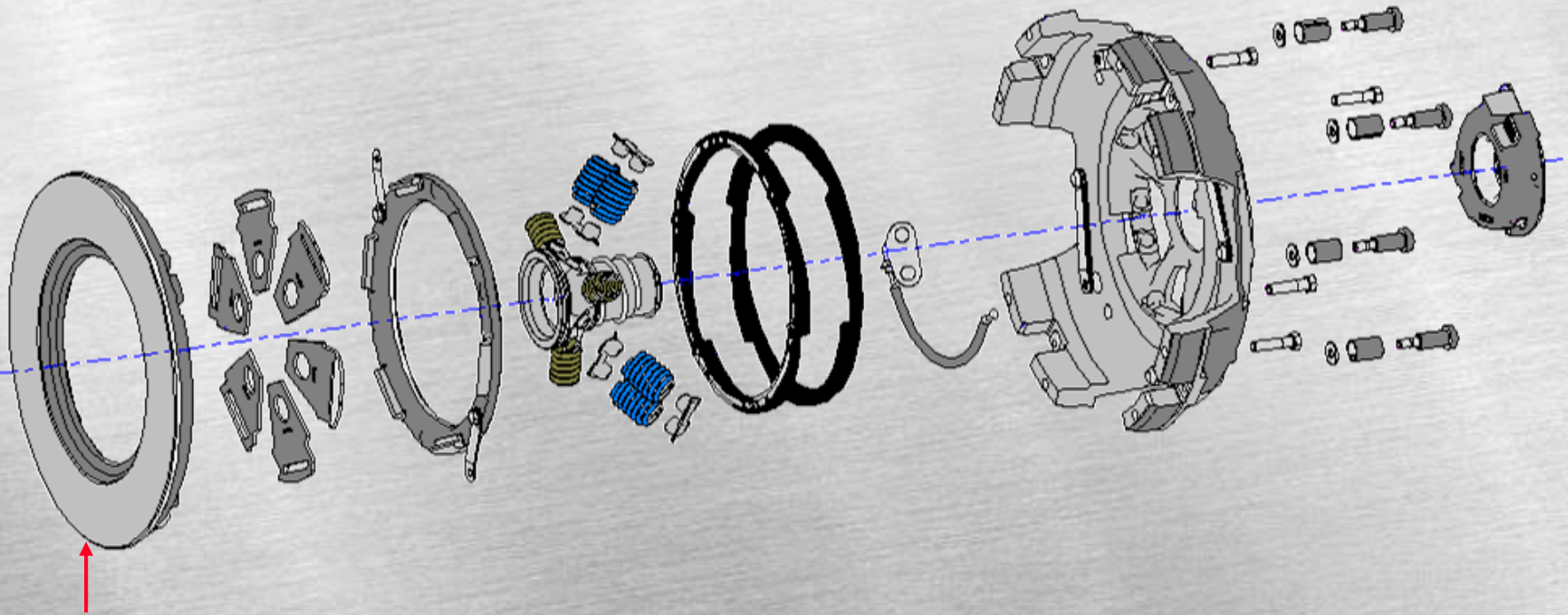
Retainer: Supports the Pressure Springs, Assist Springs, and Levers. It is attached to the release bearing by means of a 'sleeve.' Therefore, bearing movement affects the position of springs and levers, allowing for clutch engagement and disengagement.

Cams



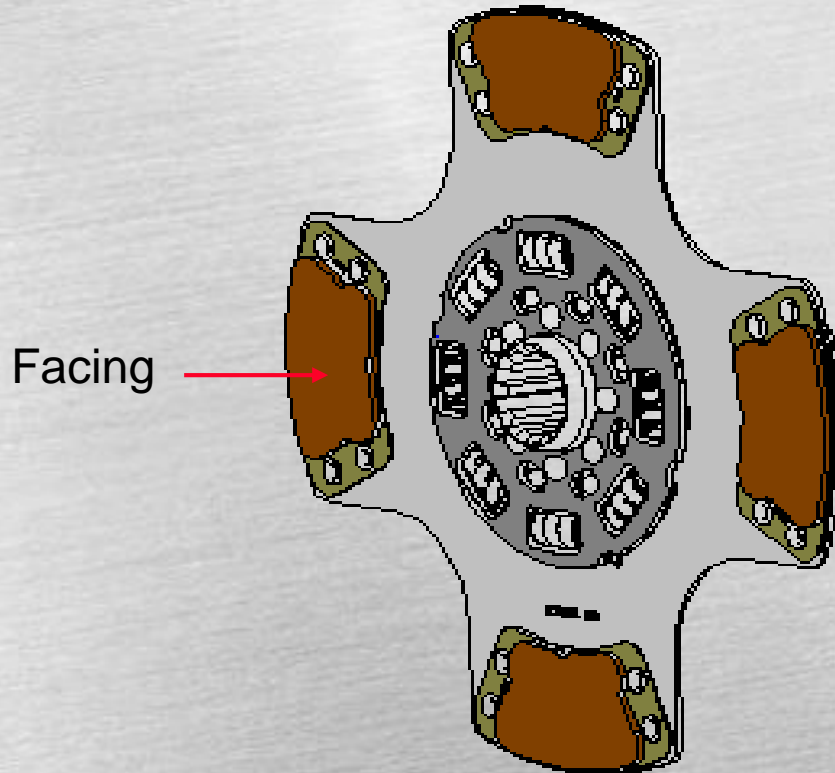
Cams (or Adjusting Ring): Rotate to internally compensate for facing wear. In the **Solo**, the **Cams** rotate automatically to compensate for wear. In the **Easy Pedal**, the **Adjusting Ring** has to be manually rotated to compensate for wear.

Pressure Plate



Pressure Plate: Provides a clamping surface for the driven disc, allowing for engine torque to be transmitted to the disc and eventually the transmission input shaft.

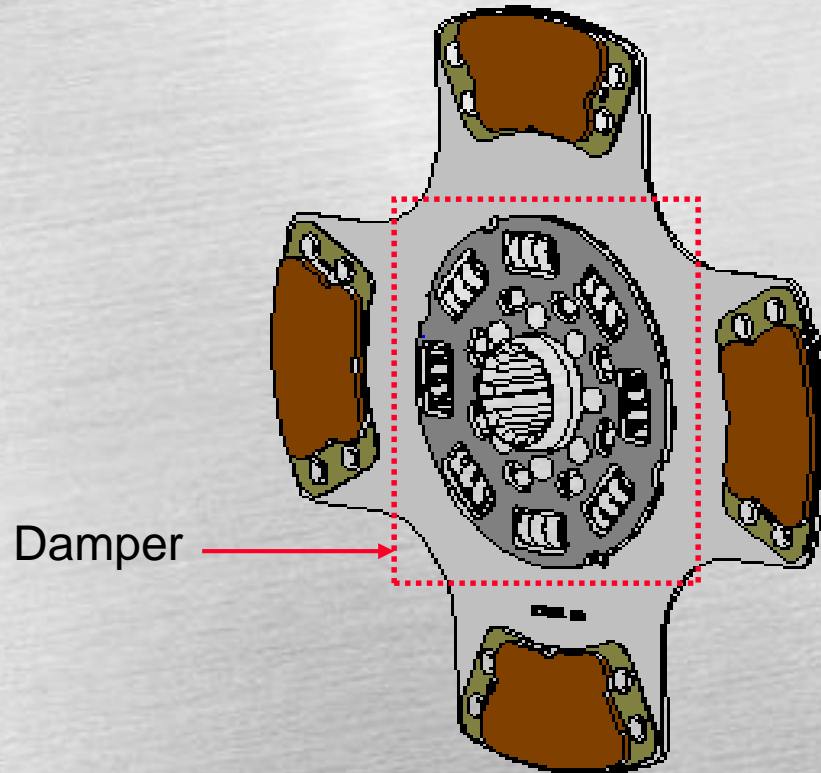
Facings



Facing

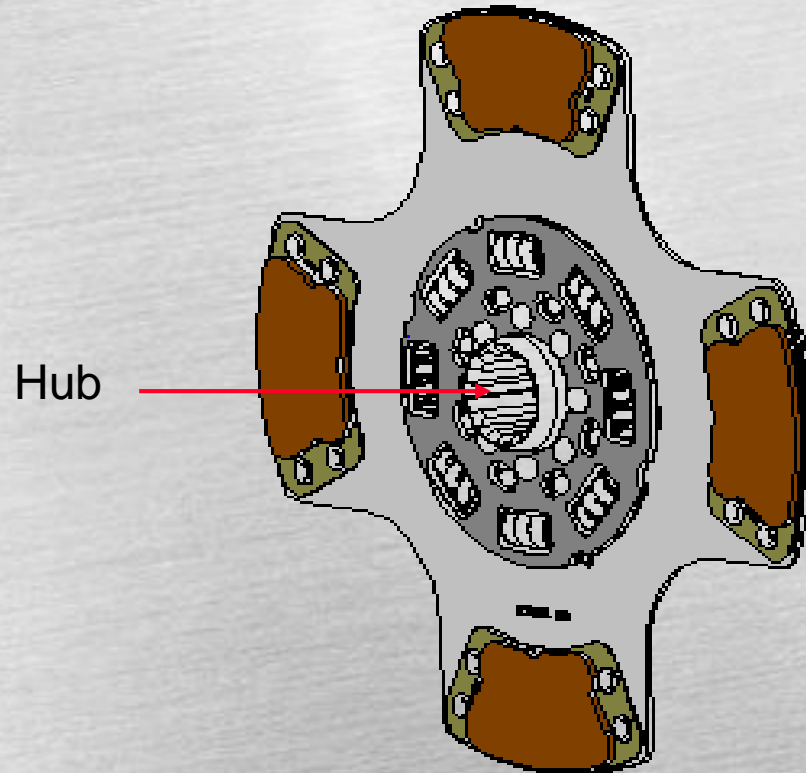
Facing: Cerametallic friction material which when clamped up between adjacent iron surfaces (pressure plate, intermediate plate, engine flywheel) causes the disc to rotate in unison with these components thereby translating flywheel rotation into transmission input shaft rotation.

Damper



Damper: A set of springs radially arranged around the hub to prevent torsional vibrations (generated by the engine) from being transmitted to the hub, and in essence the rest of the driveline.

Hub



Hub: A toothed component that mates with the transmission input shaft, and is the point of torque transfer to the transmission.

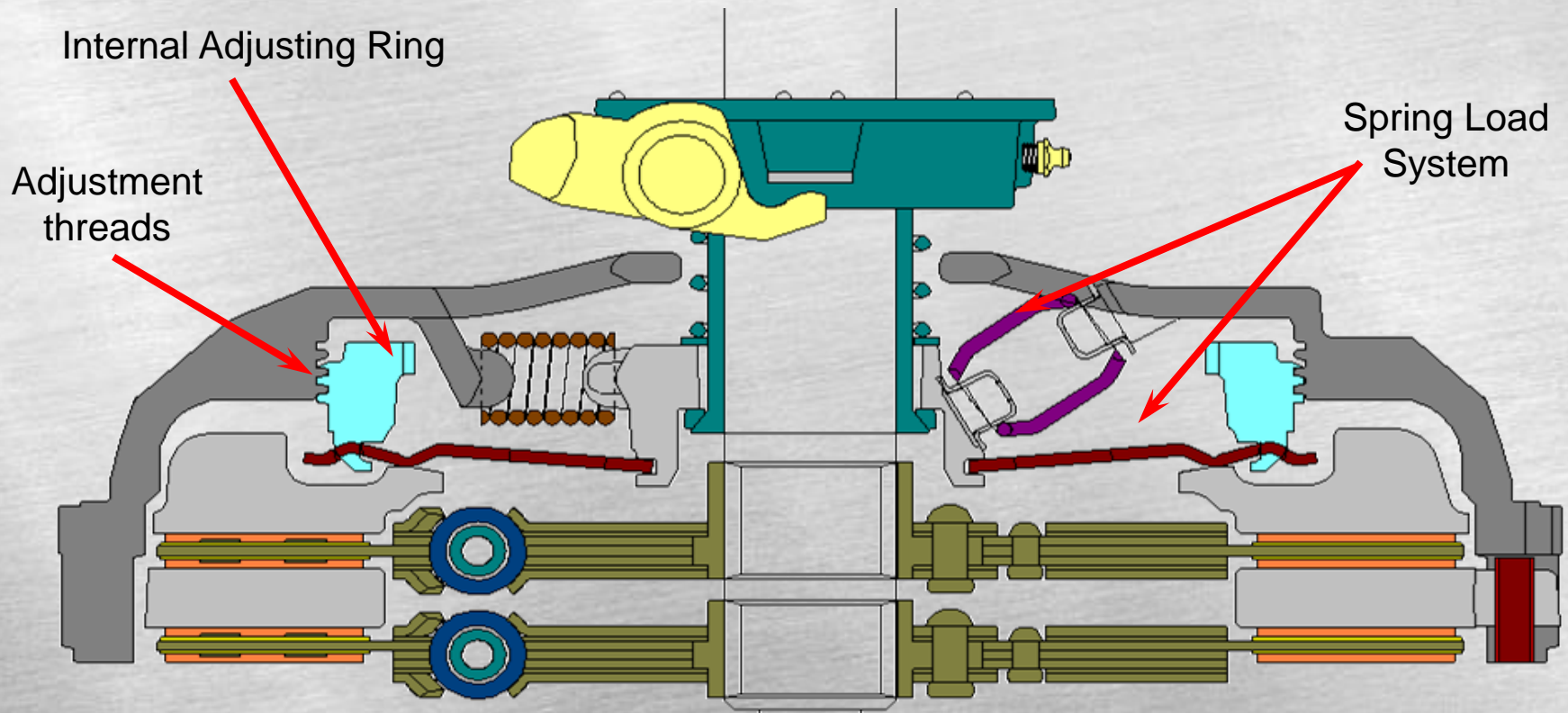
Clutch Cover Types

- Push or Pull
- Single or Twin Plate

“Push or Pull”

- Indicates the direction in which force is applied to the release bearing for clutch disengagement (Disengagement = clutch pedal depressed)
 - PUSH: Bearing moves towards the engine
 - PULL: Bearing moves away from the engine

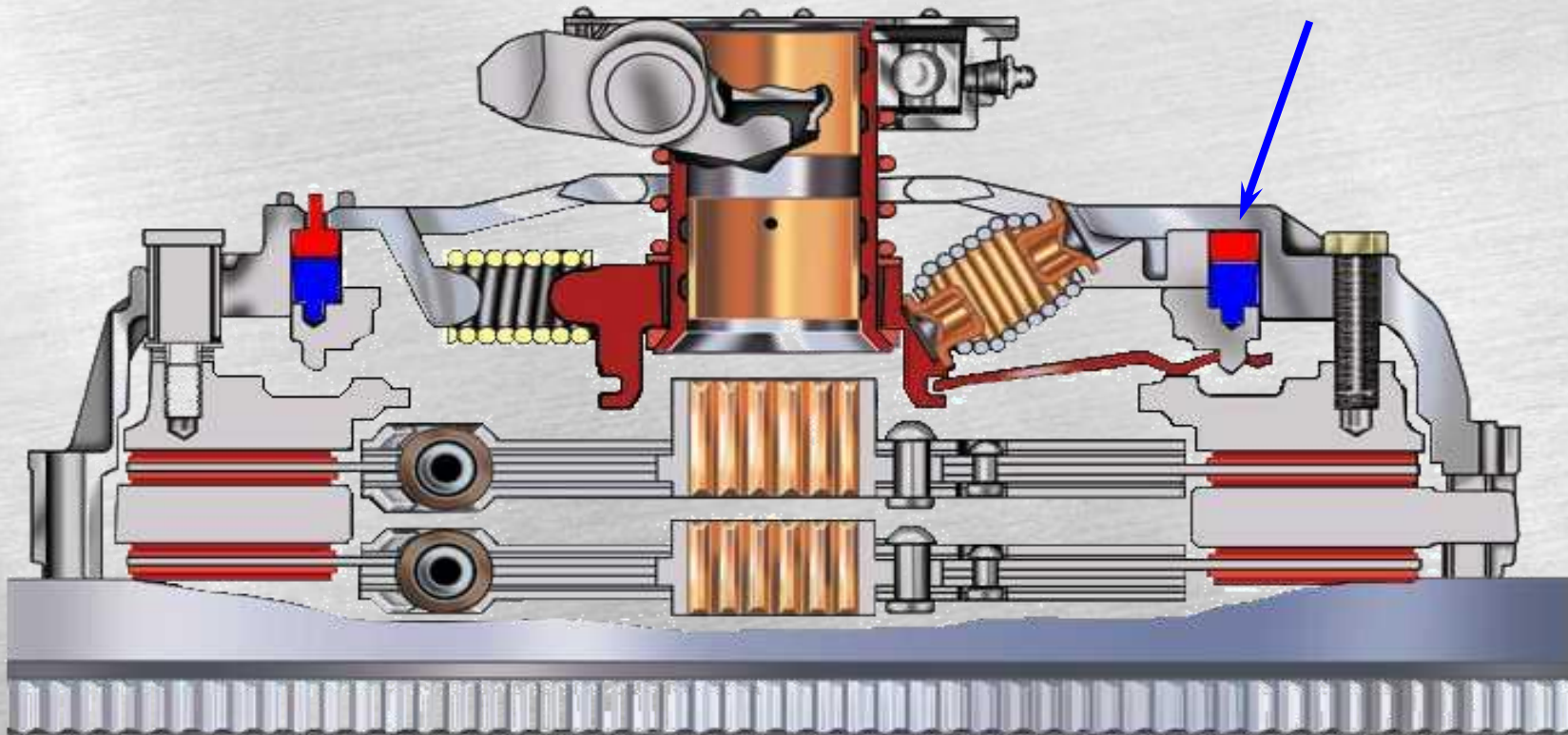
Adjustable - Manually adjusted, Angle spring type



Clamping force is generated by coil springs and then amplified by the levers. The clamp load remains constant because the springs are periodically repositioned by manual rotation of the adjusting ring.

Adjustable - Automatic, Solo type

Threaded adjusting
ring is replaced by
opposing cam ramps



The threaded adjusting ring is replaced by two opposing ramp sections (cams) which are spring loaded to provide automatic compensation for facing wear. Therefore, the clamp load remains constant without manual adjustment.

Disc Types

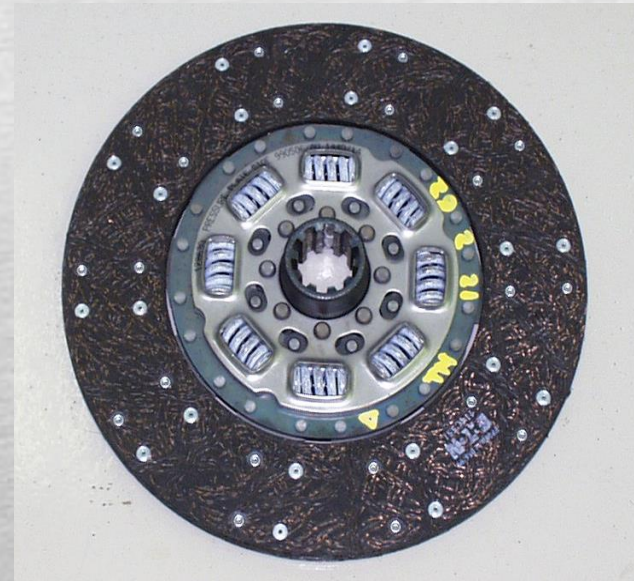
- Friction Materials
- Torsional Dampers

Friction Materials

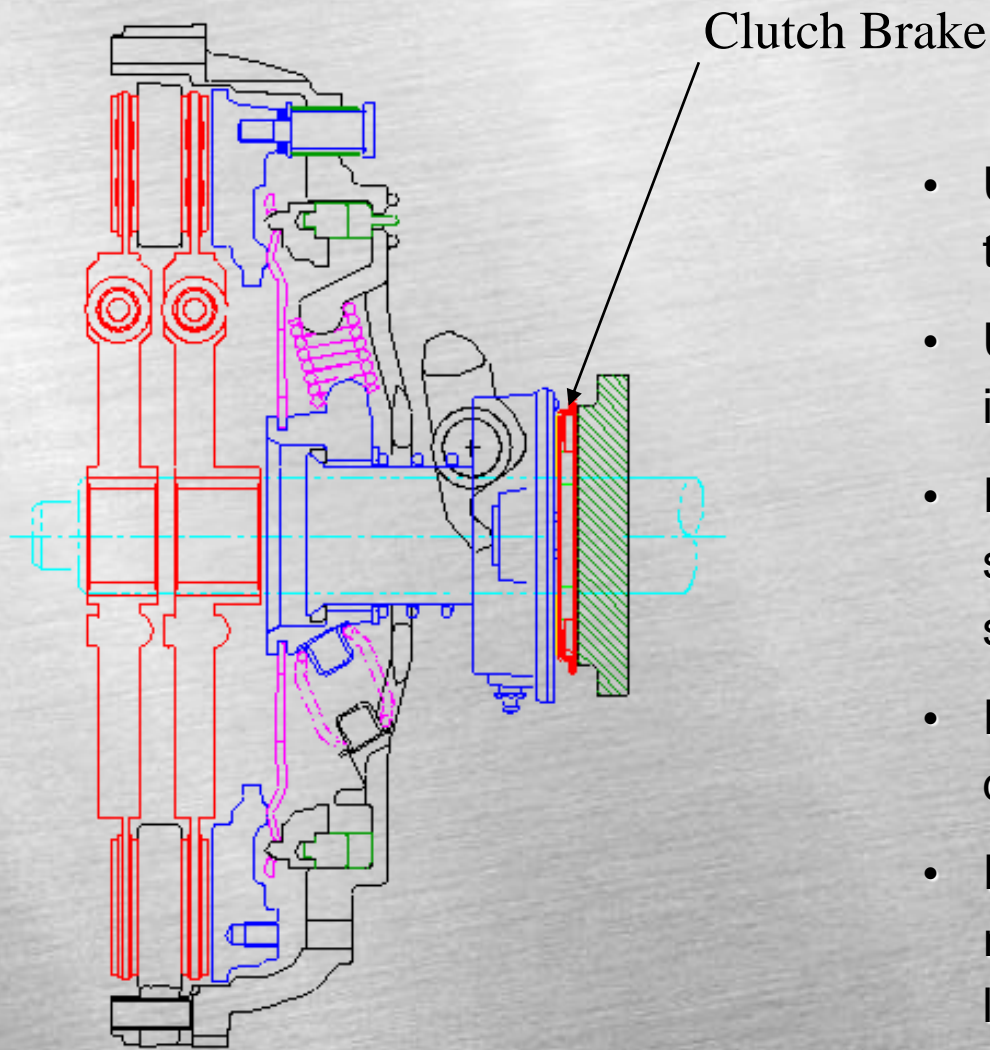
Ceramic Facing



Organic Facing



Clutch Brake



- Used with non-synchronized transmissions.
- Used to stop rotation of the input shaft, i.e. clutch discs.
- Improves shift time when selecting gears from standstill.
- Is not used for up shifting or down shifting.
- Influences maintenance requirements for the clutch - linkage system.

Clutch Product Introduction



- MD & HD Commercial Vehicle Focus
- Single & Twin Plate
- Push & Pull Versions
- Manual Adjust, Adjustment Free & Maintenance Free
- Ceramic & Organic Facings
- Various Torsional Dampers

Medium Duty (MD) Defined

In General

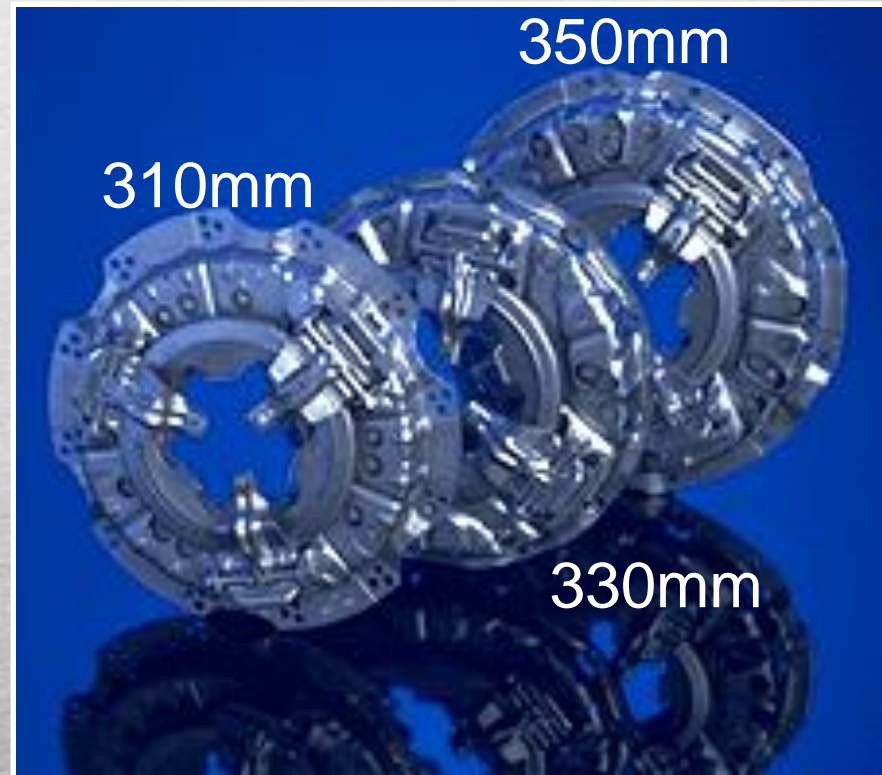
- Engine torque less than 1,150 ft.-lb.
- Stamped Steel Cover Assembly

MD Product Families

- Angle Ring (AR)
- Stamped Angle Spring (SAS)
- Medium-Duty Solo

Angle Ring (AR) Family

- Belleville Spring
- Push to Release
- No Internal Adjustment
- Single Plate only
- Up to 500 ft.-lb.
- Customers
 - GM (310)
 - UPS (350)
 - Hino (350)
 - Ford (330)
 - Freightliner (350)
 - Navistar (310 & 350)



Stamped Angle Spring (SAS) Family

- Stamped Cover
- Angled Coil Springs
- Internally Adjustable
- Pull to Release
- Bearing attached
- Up to 860 ft.-lb.

1401 = 14" - 1 Plate

1402 = 14" - 2 Plate



Heavy Duty (HD) Defined

In General

- Engine Torque Above 1,150 ft.-lb.
- Cast Iron Cover Assembly

HD Product Families

- Easy-Pedal 14" / Easy-Pedal 15.5"
- Heavy-Duty Solo

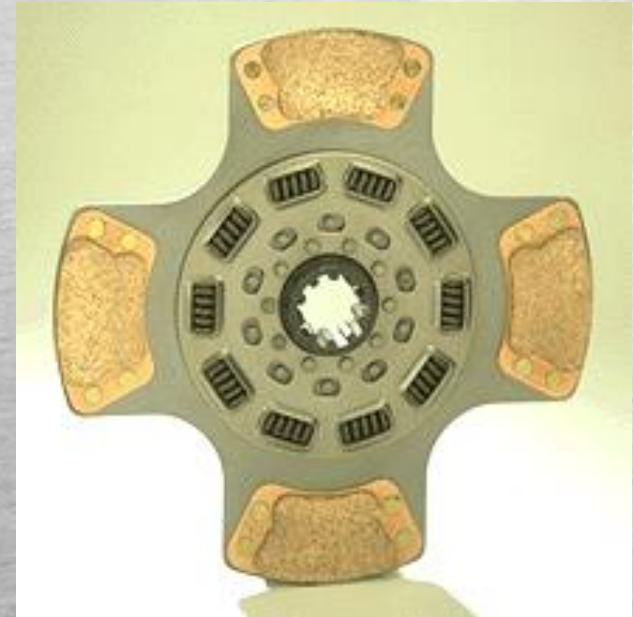
Heavy Duty Solo

- Solo = Adjustment Free
- Premium Product
- 15.5" only
- Two Plate only
- Assist Springs
- Up to 2250 ft.-lb.



Driven Discs

- Basic size 14", 15.5", 310, 330, 350
- Spline size 1-3/8, 1-1/2, 1-3/4, 2.00"
- No. of springs 6, 7, 8, 9, 10, 6-VCT
- Facing type Ceramic or Organic
- Torsional rate Standard or "Soft"
- Free travel With or Without
- No. of paddles 3, 4, 6

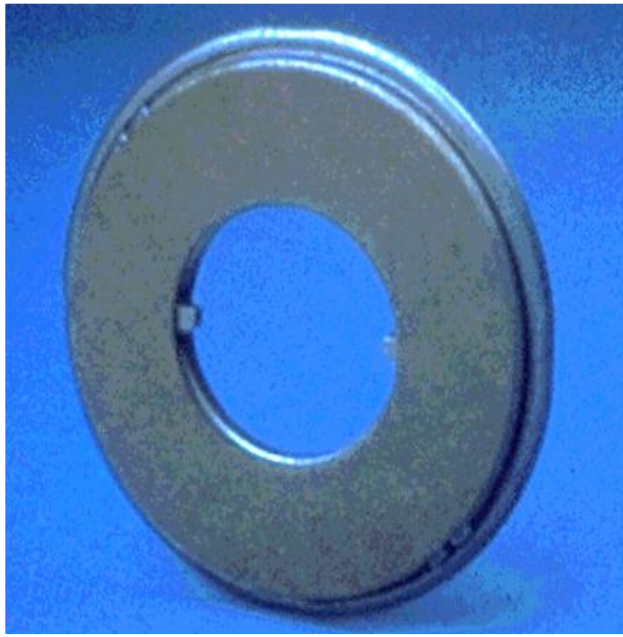


Clutch Brakes

1-3/4" and 2.00"

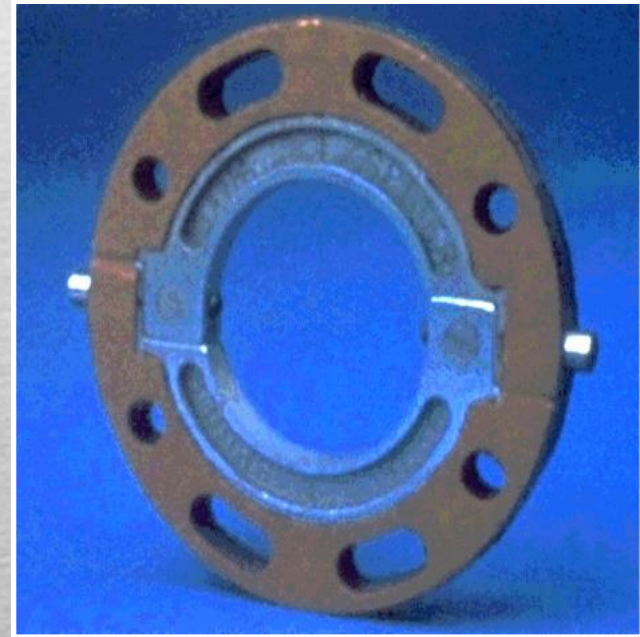
Single piece - "Torque Limiting"

Two piece - Non - torque limiting (service only)



Torque Limiting

(Prevents damage from overload)



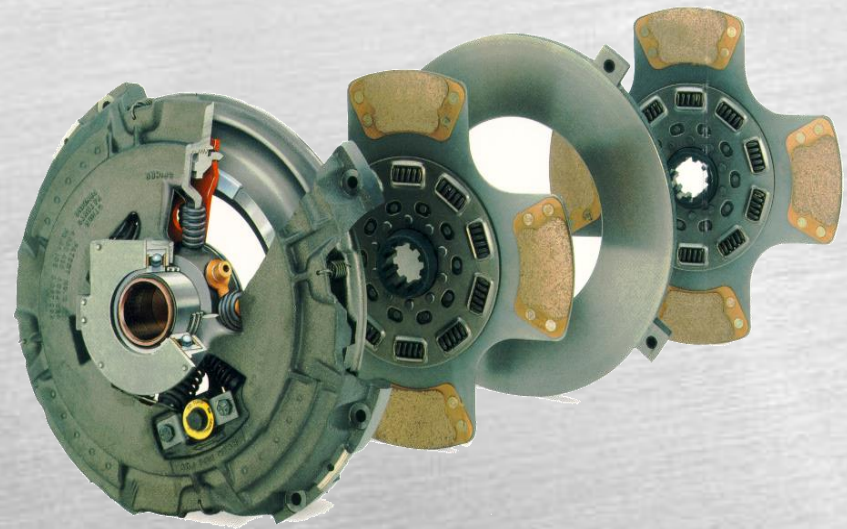
Kwik-Konnect™

(2-Piece design allows easy replacement)

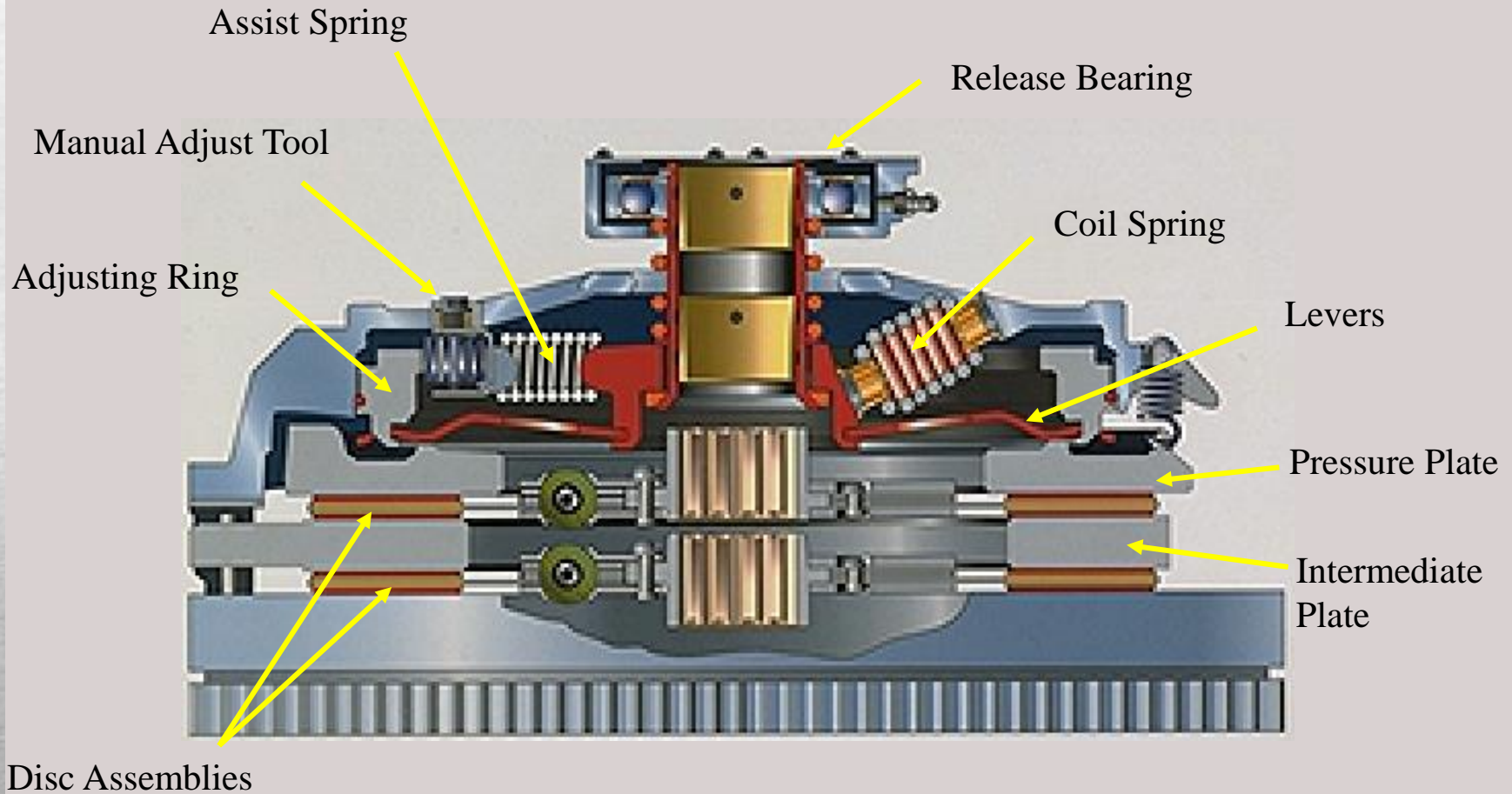
The Easy Pedal Clutch

The Easy Pedal Clutch improved driver ergonomics for a changing driver pool

- Greatly Reduced Clutch Pedal Effort
- Improved Clutch “Feel” for Easier Operation
- Simplified Adjustment Procedure



Easy Pedal (Angle Spring) Components



15.5" Easy Pedal

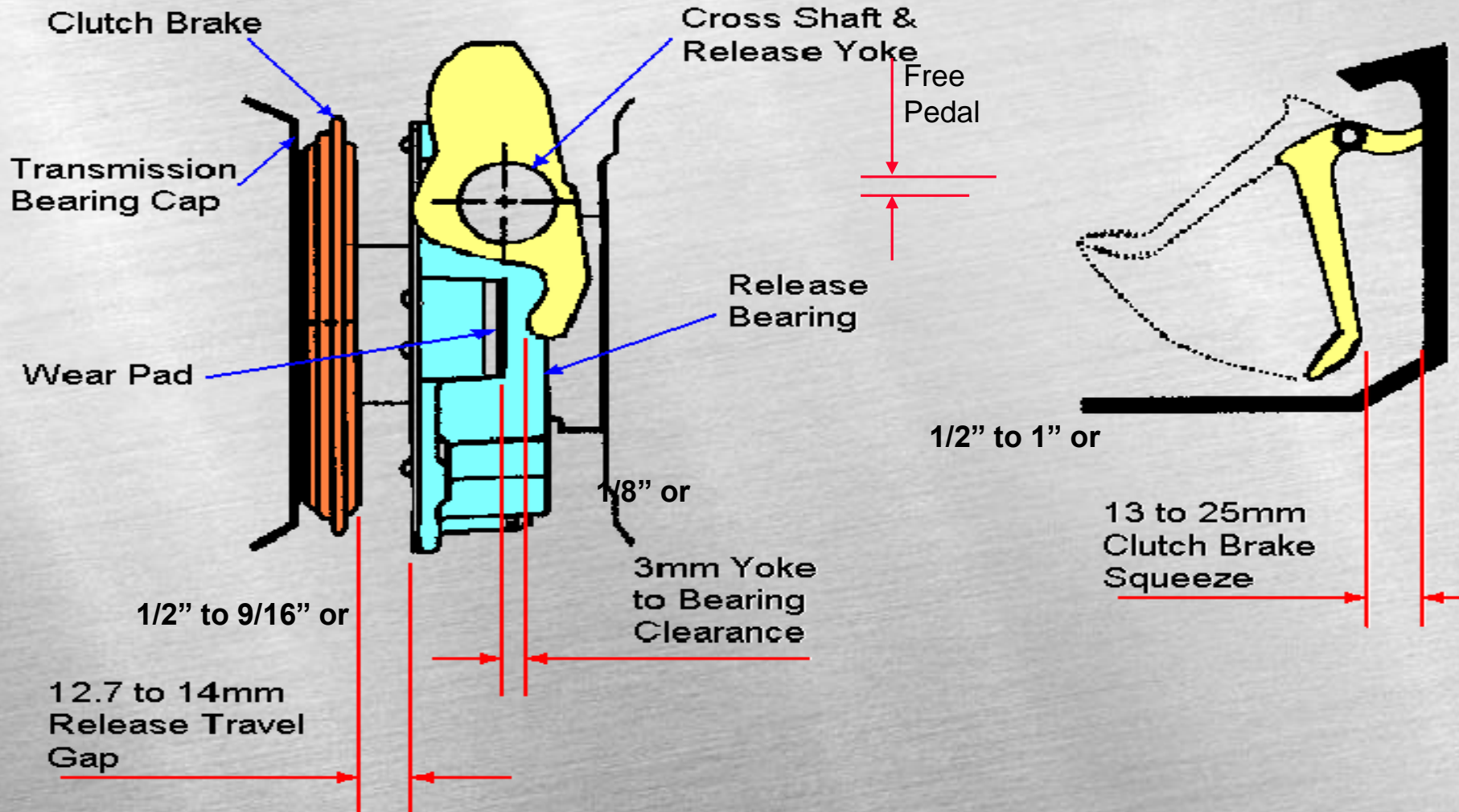
- Industry Standard Clutch
- Large application range
 - 1050 to 2050 ft.-lb.
 - 8-Spring
 - 10-Spring
 - 7-Spring
 - 9-Spring
 - 6-Spring V.C.T.



Effects of Wear

- As the clutch facings wear, the release bearing advances slowly towards the flywheel
- The gap between the yoke and bearing pad decreases and the release travel increases
- The cab Free Pedal decreases
- The clutch must be manually adjusted to maintain a gap of 1/2" - 9/16" between the Bearing Housing and the Clutch Brake
- DO NOT ADJUST THE MECHANICAL LINKAGE

Basic Clutch Settings



Basic Clutch Settings

- The clutch is manually adjusted to ensure 1/2" to 9/16" release travel at the bearing and 1/2" to 1" clutch brake squeeze at the clutch pedal (**This is required for proper function**).
- The mechanical linkage is manually adjusted to achieve 1/8" of release yoke to bearing pad clearance (**This is required because the mechanical linkage does not compensate for clutch movement due to wear**).
- The Cab Pedal will have Free Play in the UP position and Clutch Brake Squeeze in the DOWN position.

Service Intervals

- It is recommended that the release bearing is lubricated every 10,000 miles for on-highway applications and once a month for off-highway applications (lube intervals vary by product family and application)
- Use a lithium soap based, extreme pressure grease with a minimum temperature of 160°C
- Pump in grease until it is seen coming out of the release bearing cover, allowing excess grease to contact the clutch brake
- ALWAYS CHECK FOR CORRECT CLUTCH ADJUSTMENT WHEN LUBRICATING THE BEARING

Eaton Fuller Solo

Adjustment-Free Clutches



**THE CLUTCH THAT THINKS
IT'S A MECHANIC.**



Available in Both Medium and Heavy-Duty Models

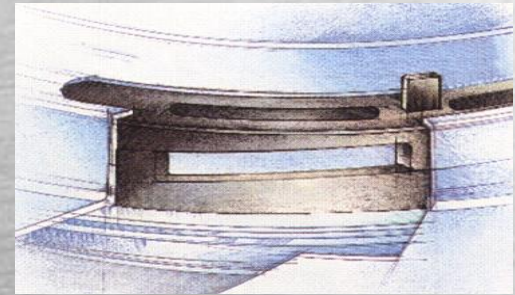
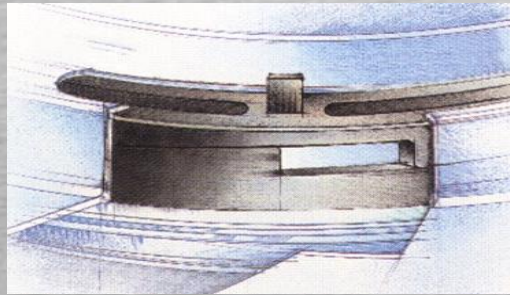
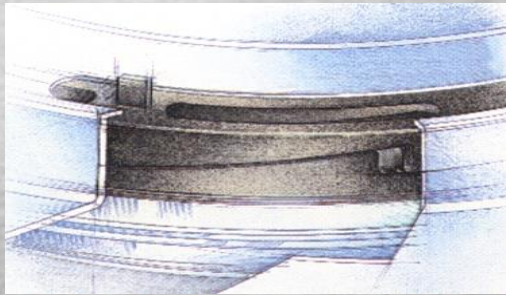
Solo Features

- Automatically Sets New Position at Installation
- Adjustment-Free
- 100% Compatibility
- Longer Life due to Continuous Proper Clutch Adjustment and Advanced New Materials
- Less Drag and Flywheel Wear
- Wear Indicator
- Compensates for Linkage/Environment
- Improved 1st and Reverse Shifting
- Constant Bearing Load/Pedal Effort

Solo...

Solo Technology

- Spring Loaded Cam Rings - Adjusts for Proper Clearance with Every Release
- Wear Indicator Tab- Reflects Cam Movement
- Visual Inspection of Available Clutch Life



Wear Indicators

Medium-Duty



Heavy-Duty



Monitors Clutch Wear and Indicates When it is Time to Replace Clutch

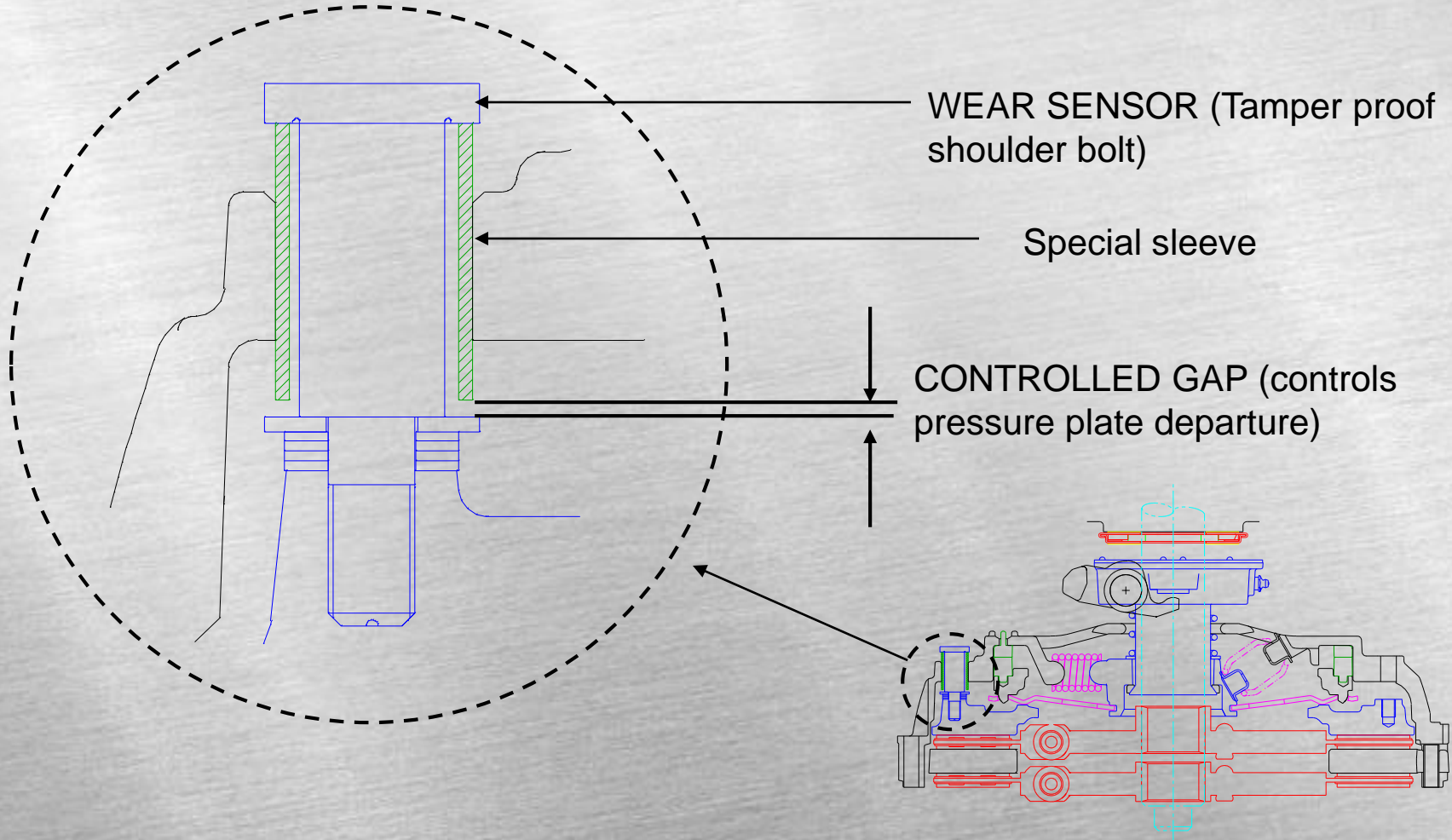
Solo - How It Works

Release travel/pressure plate departure based automatic adjustment system

Important Items:

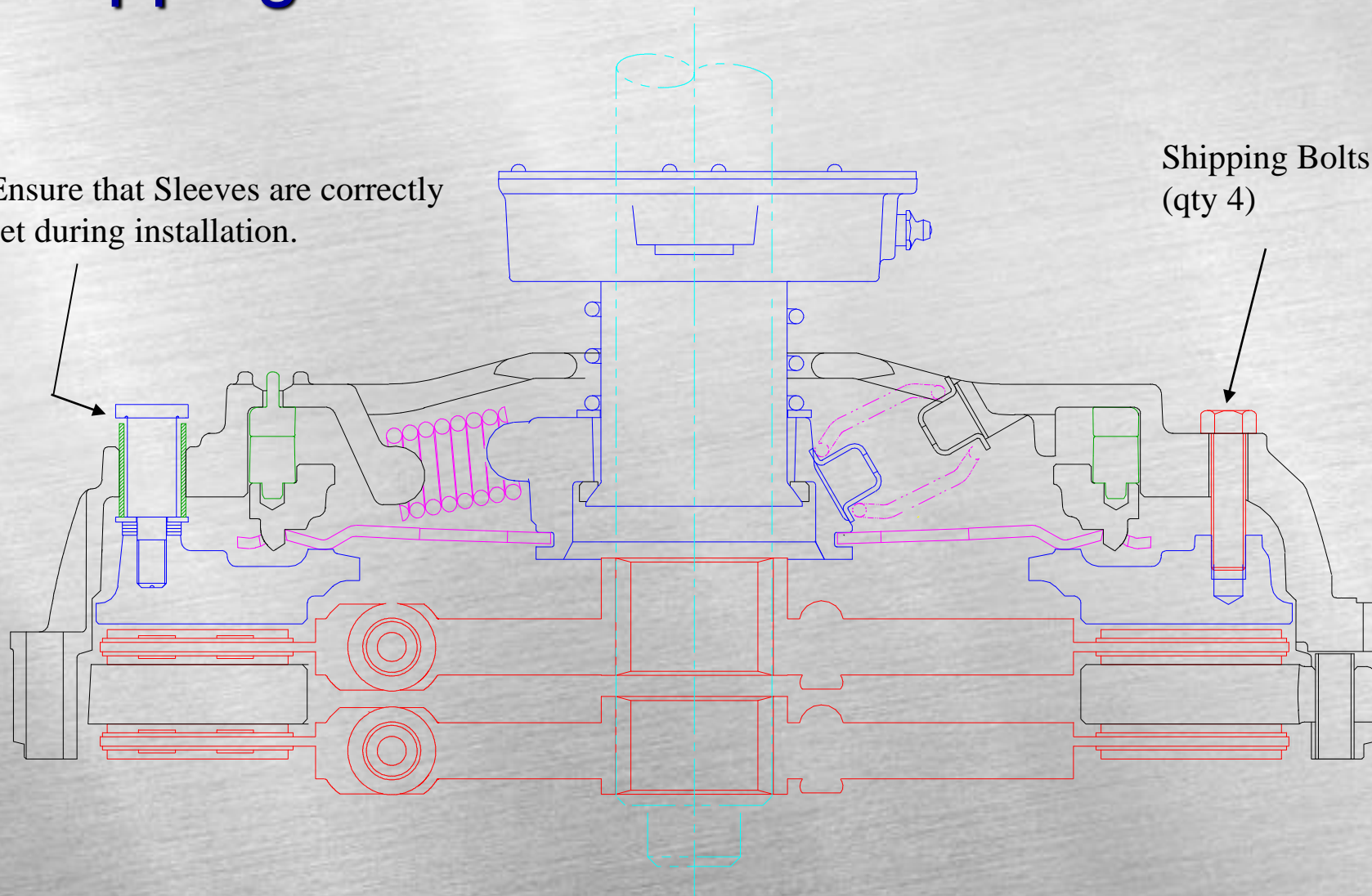
- Wear Sensor
 - Detects wear on the friction surfaces
- Controlled Gap
 - Activates the adjustment system once wear has occurred
- Cams
 - Rotate, increasing in axial thickness, compensating for the wear
- Shipping Bolts
 - Ensures proper installation

Wear Sensor/Departure Control Device



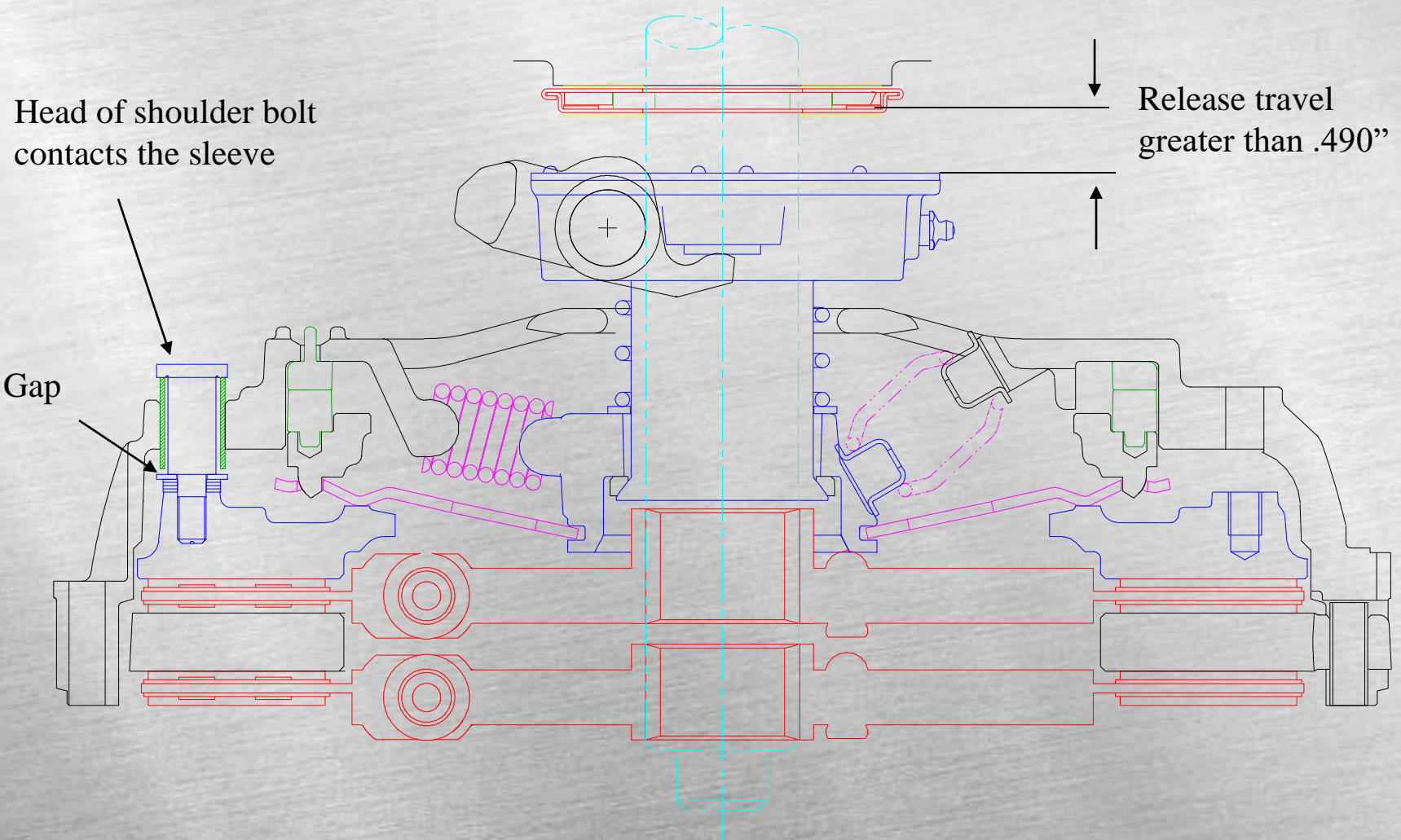
Shipping Bolts Installed

Ensure that Sleeves are correctly set during installation.



Shipping Bolts
(qty 4)

Shipping Bolts Removed - Transmission Installed

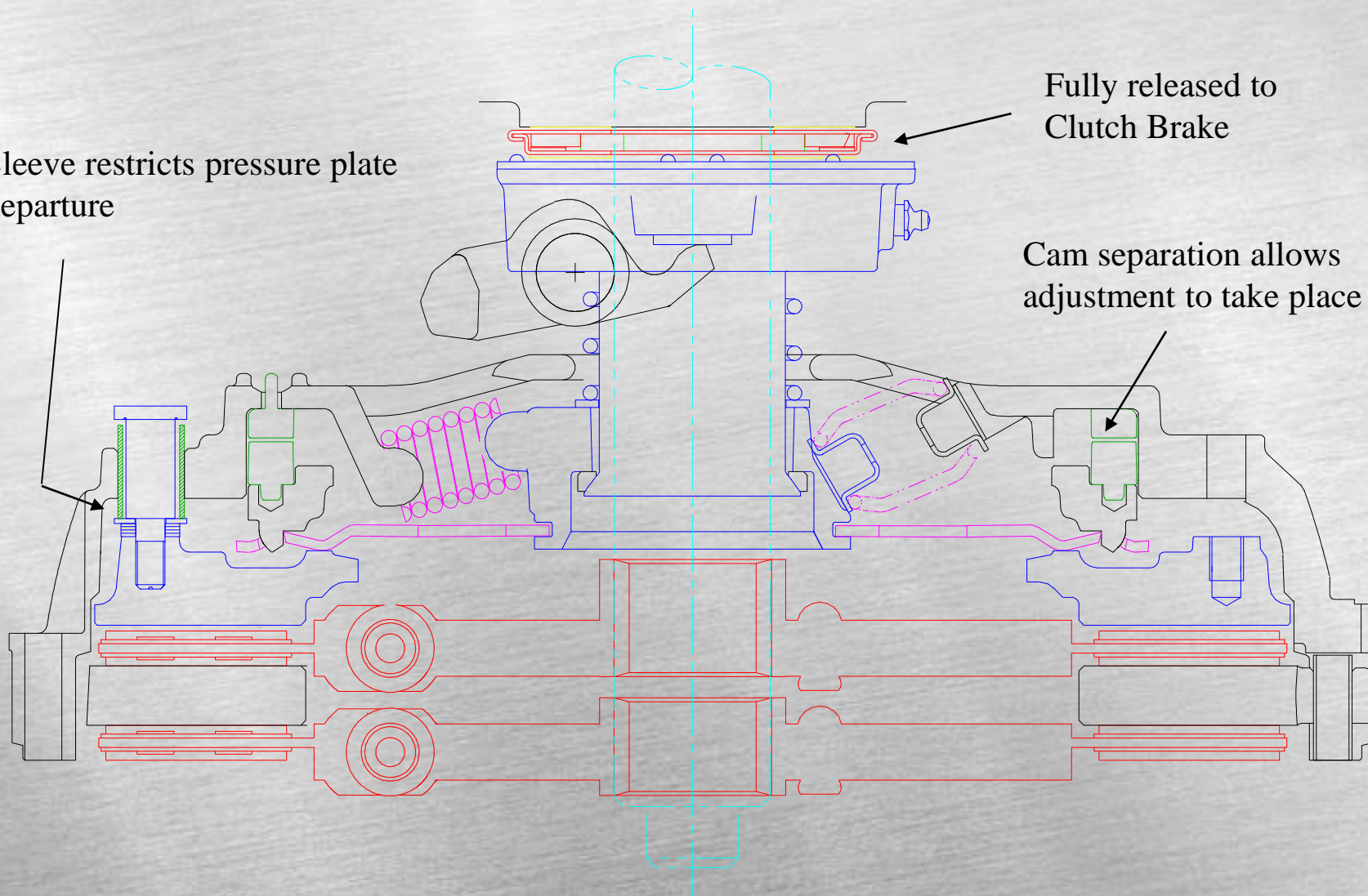


Clutch Actuated 5 Times

Sleeve restricts pressure plate departure

Fully released to Clutch Brake

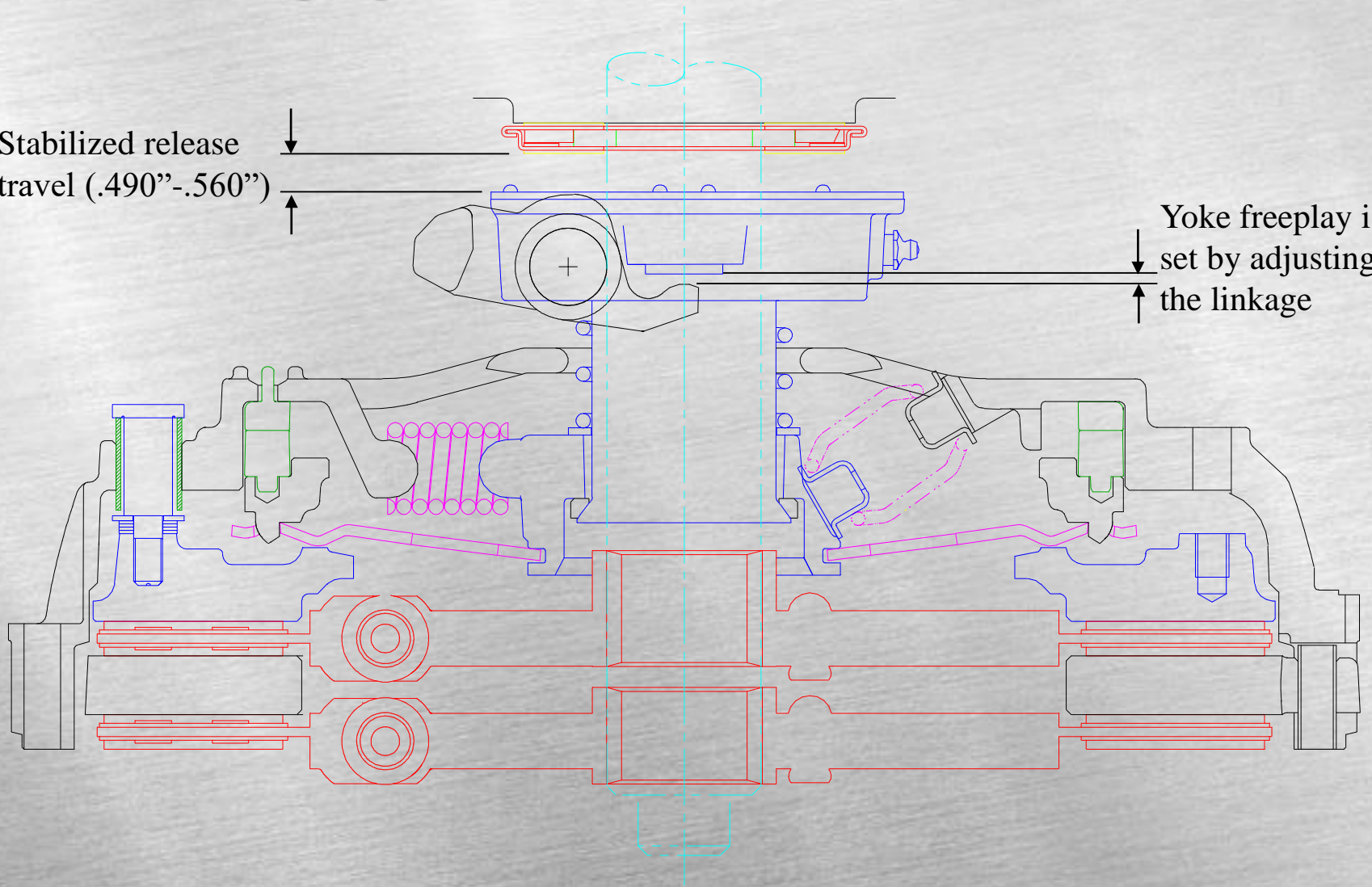
Cam separation allows adjustment to take place



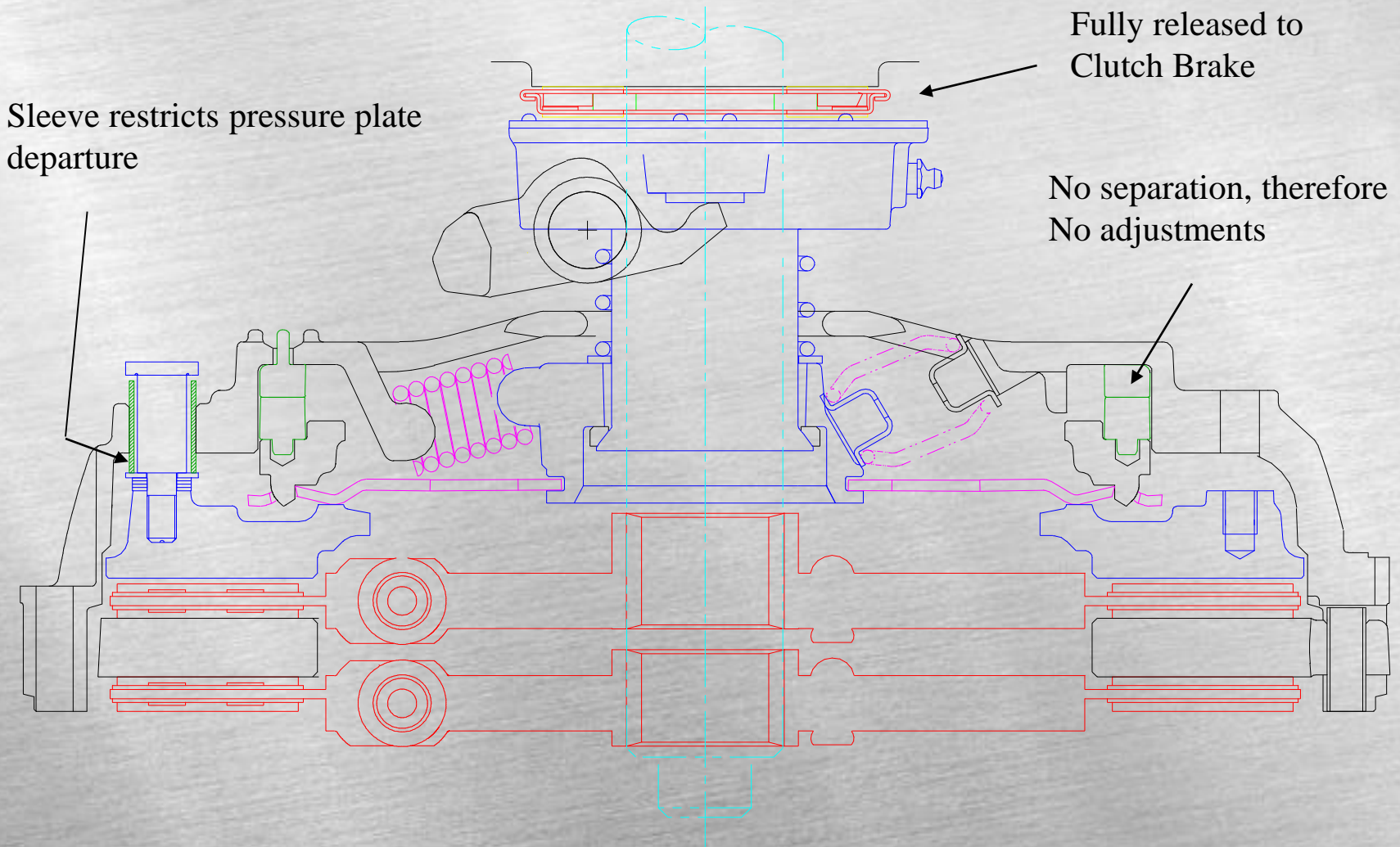
Clutch Engaged - Bearing Travel Stabilized

Stabilized release
travel (.490"-.560")

Yoke freeplay is
set by adjusting
the linkage



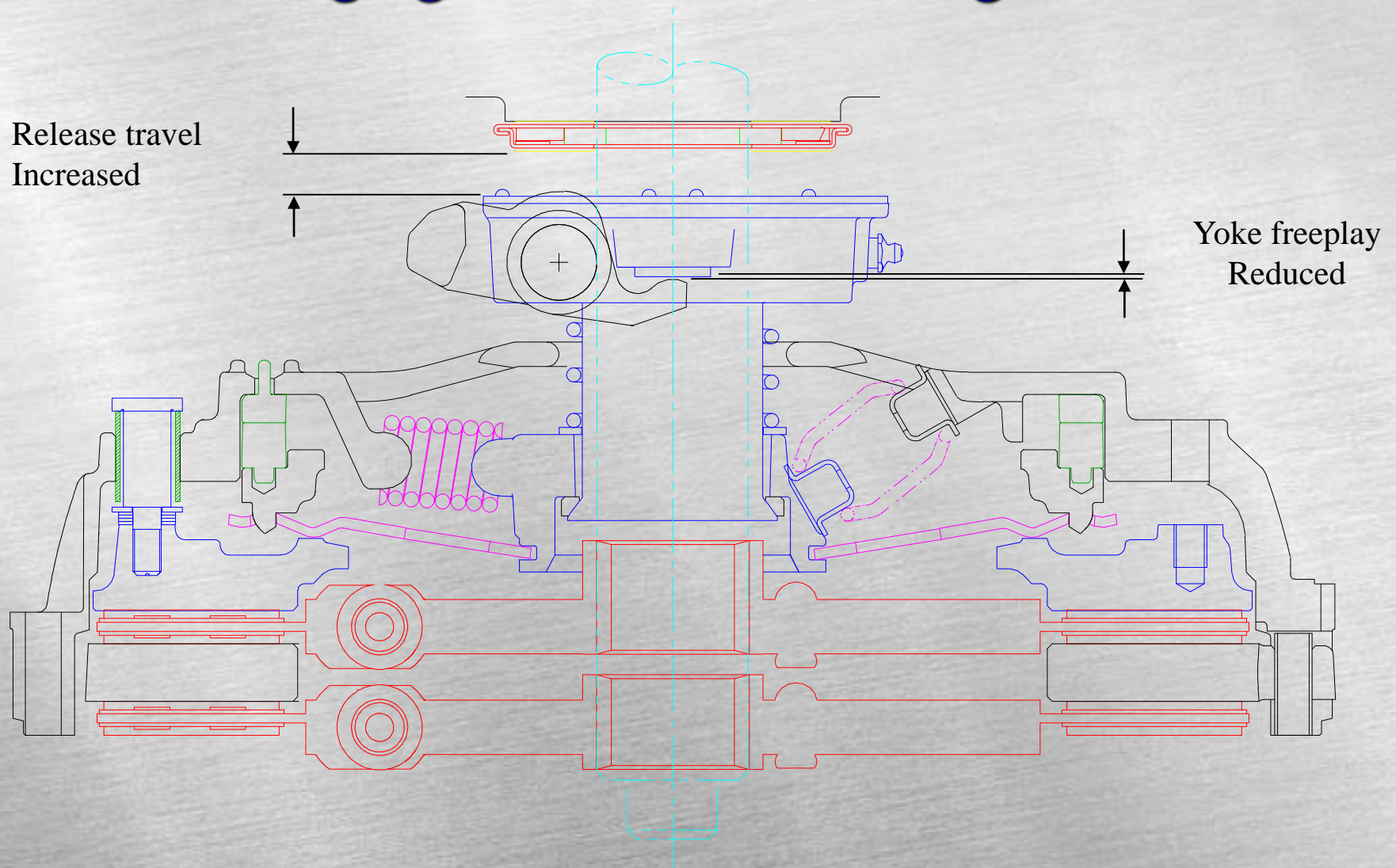
Clutch Disengaged - Bearing Travel Stabilized



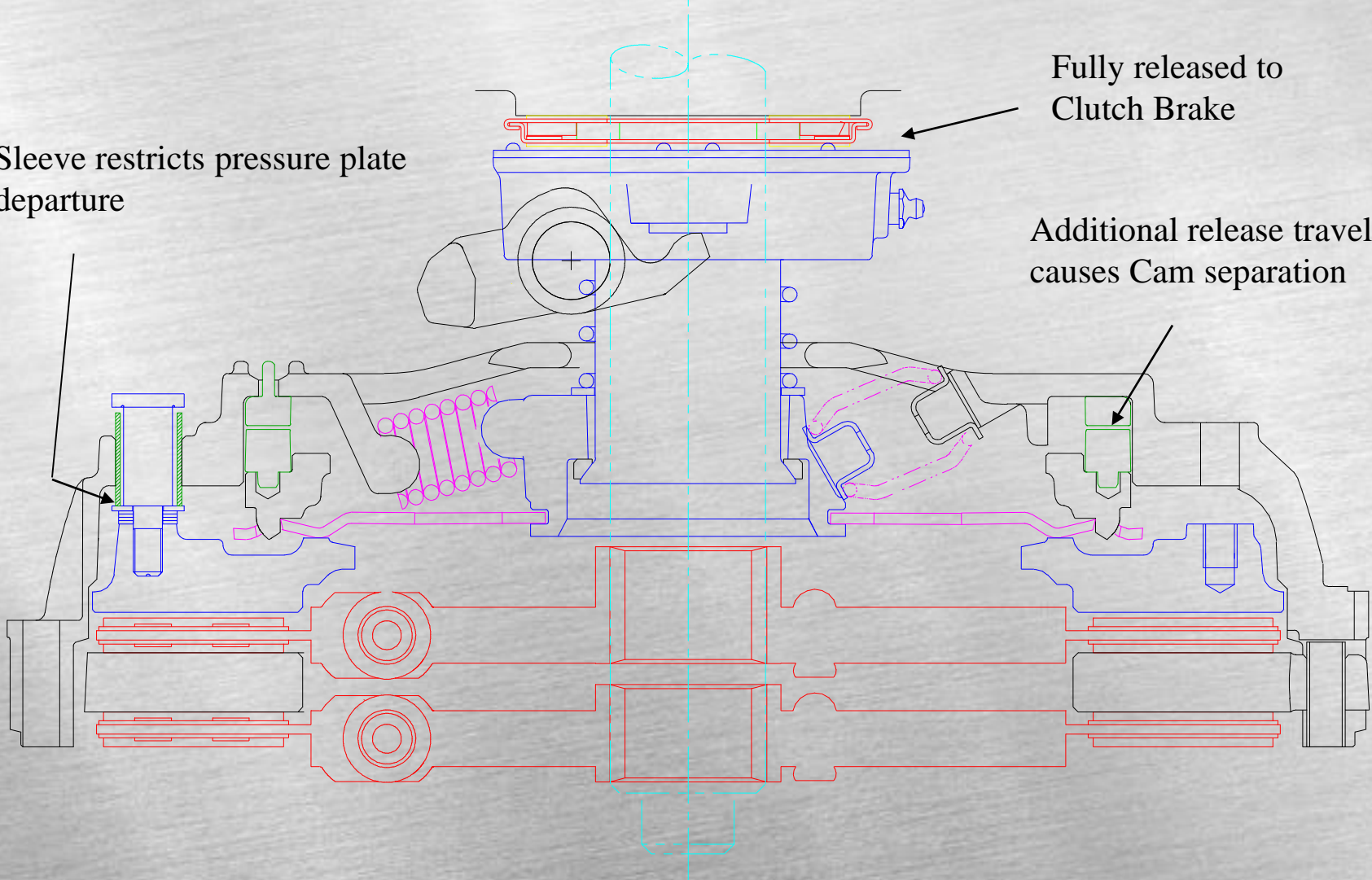
Stabilized Release Bearing Travel

- When no facing wear has occurred and no clutch adjustments are required, we refer to the release bearing travel as being stabilized
- The release bearing travel stabilizes based upon the release travel required to achieve full pressure plate departure, which is set by the four wear sensors
- As the clutch facings wear, the release bearing moves towards the engine, thus reducing yoke free play
- Therefore, on the next full disengagement (i.e. to the clutch brake), the release bearing travel has increased
- It is this increase in release travel which causes the clutch to adjust

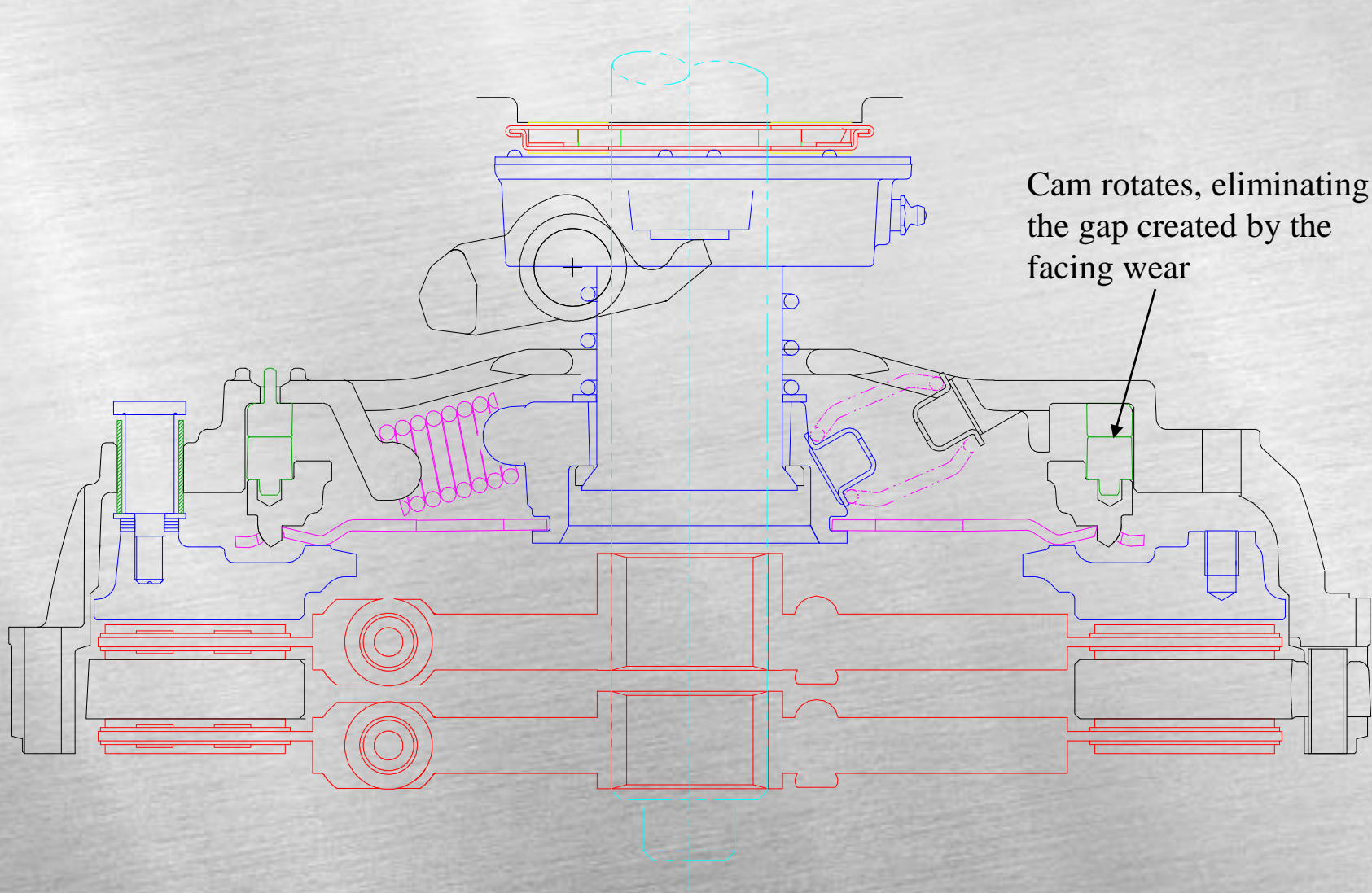
Clutch Engaged - After Facing Wear



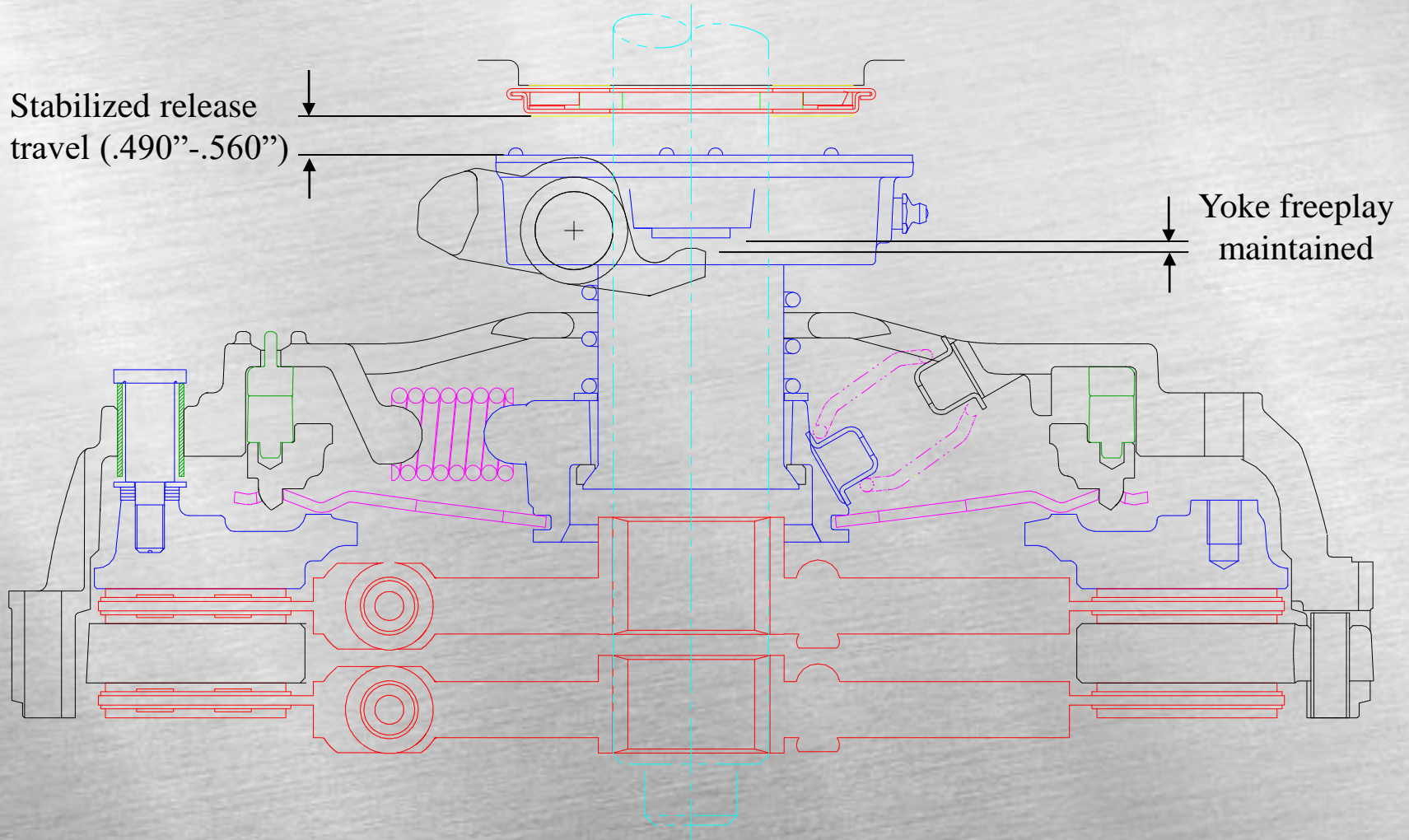
Clutch Disengaged - After Facing Wear



Clutch Disengaged - After Adjustment



Clutch Engaged - Stabilized Position is Re-established



Solo Installation

- Install Clutch Normally
- Remove Shipping Bolts
- Install Transmission & Linkage
- Actuate Pedal 5 Times
- Adjust Linkage for Free Pedal
(Mechanical Linkage Only)

Click icon for animation



Dampers



Industry Engine Trends

- Peak torque engine speeds have fallen dramatically over the years from 1500 rpm to 1050-1200 rpm
- High torque engines have grown
- Over 90% of production now use 15.5" clutches
- Average 8 HP increase per year for the past 6 years



What are Torsional Vibrations?

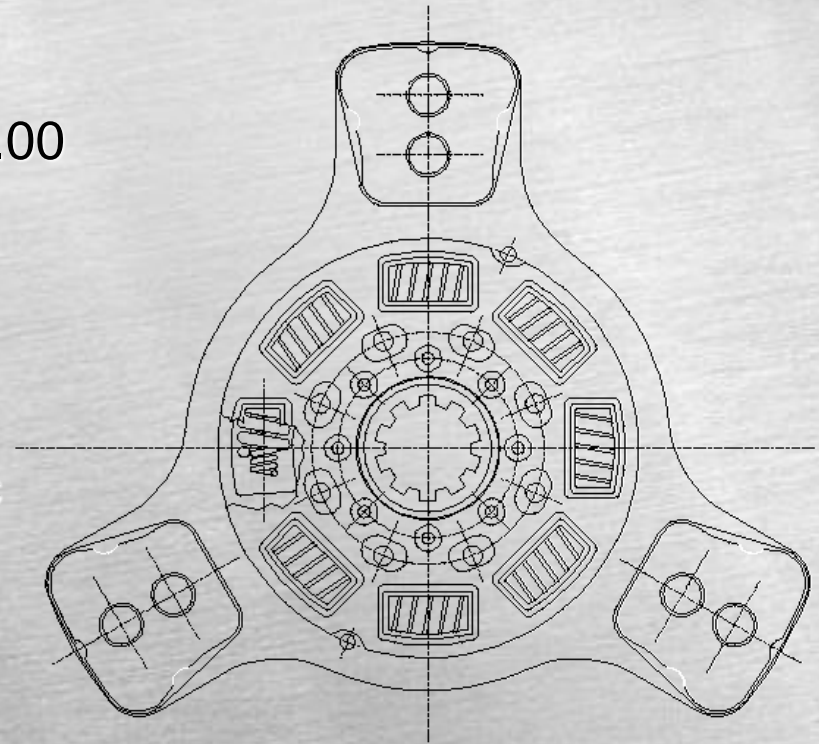
- Torsional Vibrations exist in all vehicles
- Torsional vibrations occur due to the firing of combustion gases inside engine cylinders
- All Drivetrains have “natural frequencies” i.e. periodic fluctuations of torque and speed that naturally occur

Why are Torsional Vibrations Damaging?

- Severe torsional vibrations often exist in the operating range and these can be VERY damaging
- The Clutch Damper is the key “tuning” element for the entire powertrain
- It helps shift the natural frequency of the driveline below the engine firing frequency at normal operating speeds

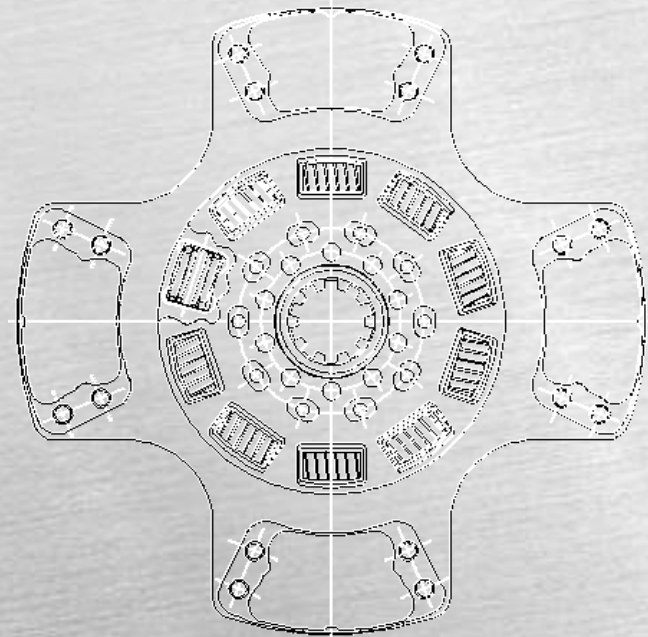
8 Spring Damper

- Basic size 310, 330, 350, 14"
- Spline size 1-3/8, 1-1/2, 1-3/4, 2.00
- Torsional rate Standard or "Soft"
- Free travel Yes or No
- Facing type Ceramic or Organic
- No. of paddles 3 or 4
- Torque limit 1,150 ft.-lb.



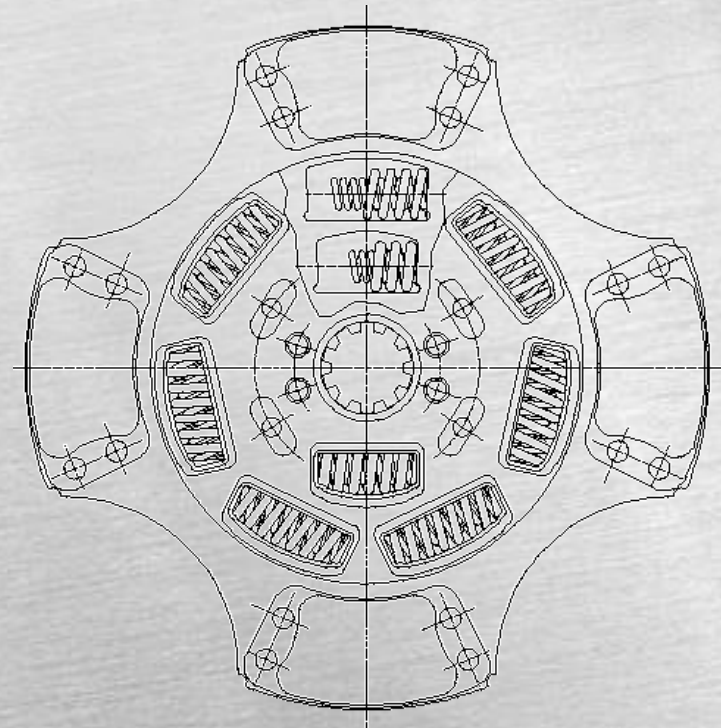
10 Spring Damper

- Basic size 15.5"
- Spline size 2.00
- Torsional rate Standard
- Free travel Yes
- Facing type Ceramic or Organic
- No. or paddles 4 or 6
- Torque limit 1,860 ft.-lb.



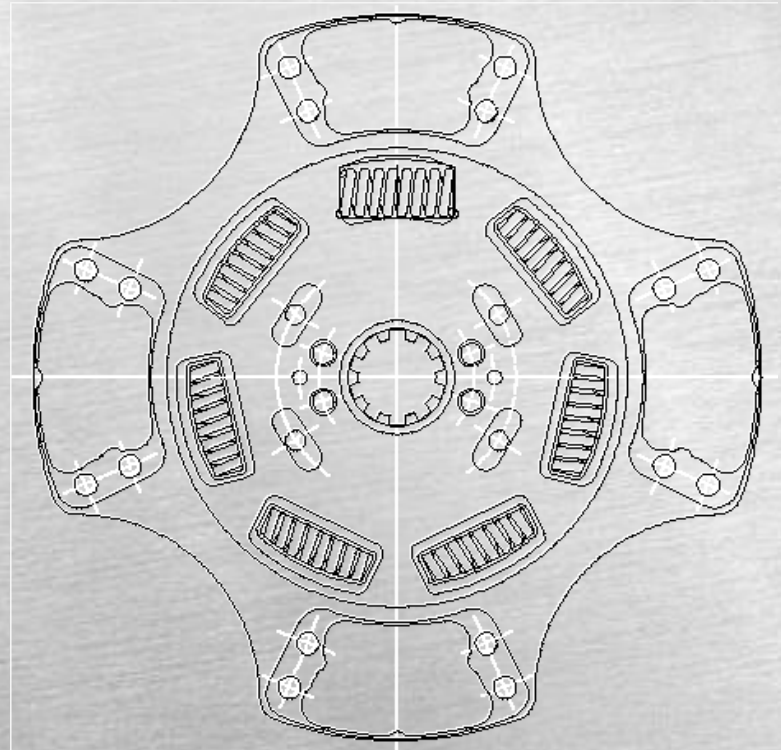
9 Spring Damper (Mack Application Only)

- Basic size 15.5"
- Spline size 2.00
- Torsional rate "Soft"
- Free travel No
- Facing type Ceramic
- No. of paddles 4 or 6
- Torque limit 1,760 ft.-lb.



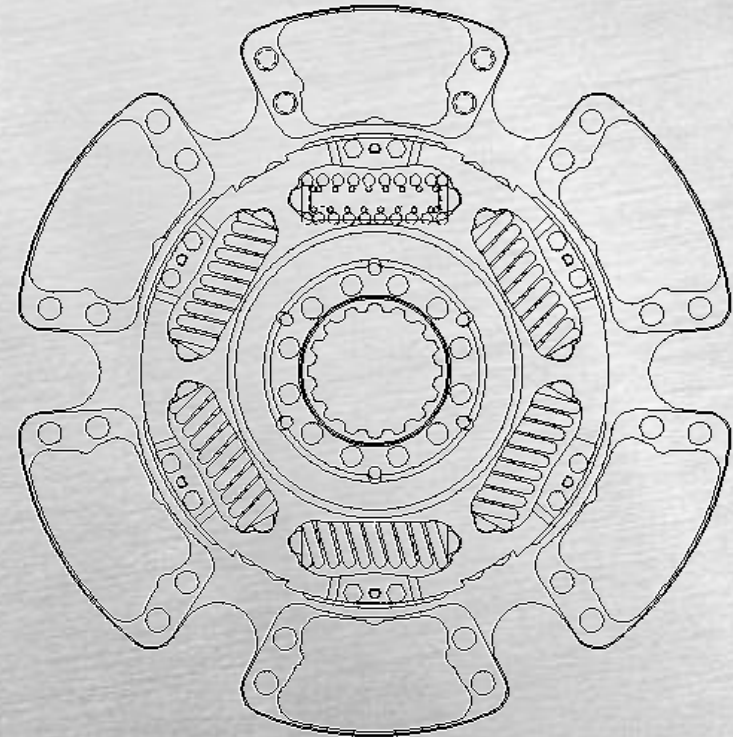
7 Spring Damper

- Basic size 15.5"
- Spline size 2.00
- Torsional rate "Soft"
- Free travel No
- Facing type Ceramic
- No. of paddles 4 or 6
- Torque limit 1,700 ft.-lb.



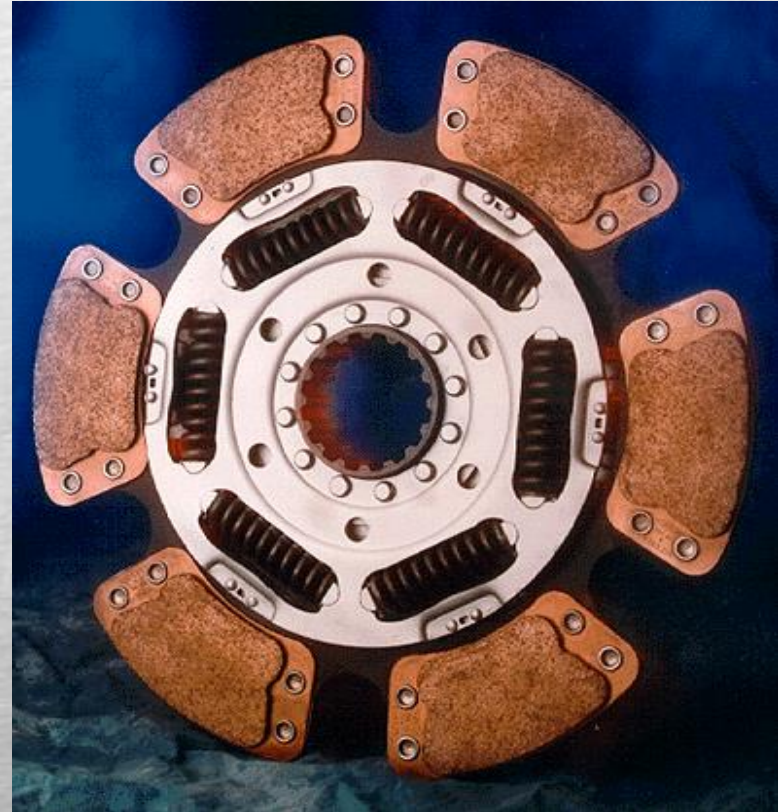
6 Spring Damper V.C.T.

- Basic size 15.5"
- Spline size 2.00
- Torsional rate "Soft"
- Free travel No
- Facing type Ceramic
- No. of paddles 6 only
- Torque limit 2,250 ft.-lb.



V.C.T. - Vibration Control Technology

- Highest Industry Rating
- 610 HP, 2250 ft.-lb.
- Modular Design
- Controlled Hysteresis for
Optimized Dampening
- Pivoting Spring End Caps
- Robust Against Damper
Overload
- Disc Symmetry eliminates
installation errors



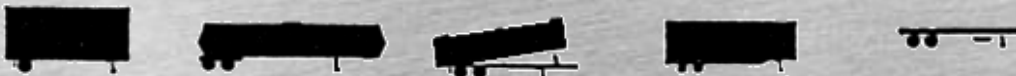
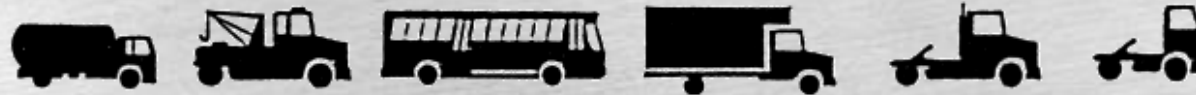
Select another topic, or Esc to Quit

Applications

Damper Design

- 8 Spring 7" Bore
- 10 Spring 8.5" Bore
- 9 Spring (Mack Only) 10" Bore => *Soft Rate*
- 7 Spring 10" Bore => *Soft Rate*
- VCT (6 Spring) 10" Bore => *Soft Rate*

Vocations



Vocational Considerations

- Eaton's standard clutch is selected to provide the best performance at the best price
- However, on some vocational applications it is worth considering a clutch upgrade to improve performance / life (\$\$ upfront versus \$\$\$\$ for repairs)
- Eaton has a wide variety of upgrades available,
 - i.e. Solo, Extended Lube bearings, Maintenance Free, increased facing area, increased clamp load, and combinations of the above

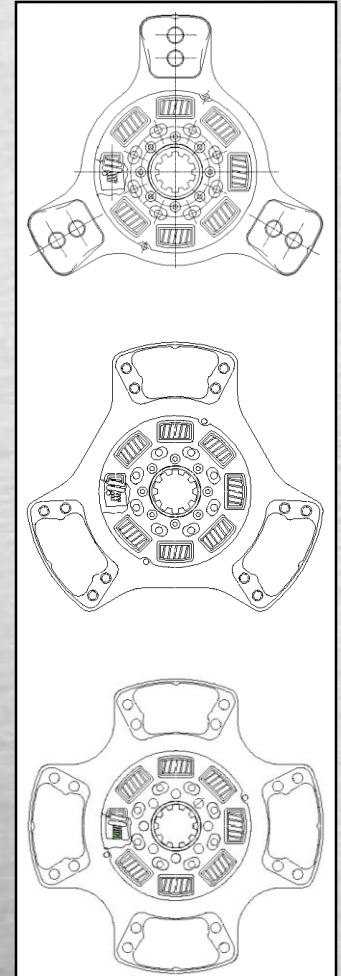
When to Upgrade

- Vocations which increase the work performed by the clutch, including;
 - frequent stop / starts
 - off highway use
 - extreme payloads
 - steep grades (mountain regions)
- International regions;
 - overload conditions
 - poor road surfaces
 - increased traffic density

Upgrade Options

Medium Duty

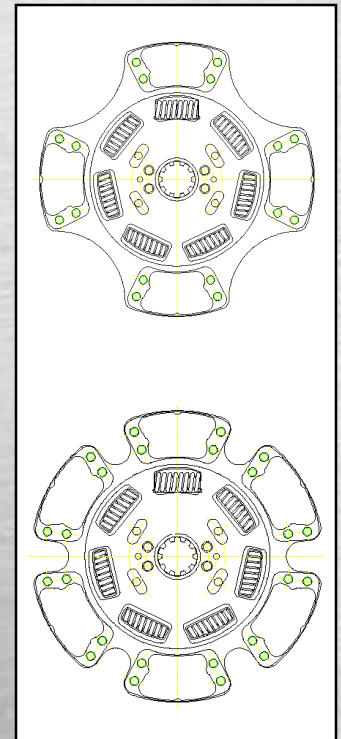
- Solo
 - eliminates manual adjustment
 - maintains constant clutch performance
- Single plate to twin plate
 - doubles wear surfaces
 - increases clutch reserve factor without increasing pedal effort
- Increased facing area
 - Trap facings to Super Buttons
 - additional facing pads
- Increase plate load
 - increases clutch reserve factor (will increase pedal effort slightly)



Upgrade Options

Heavy Duty

- This product is designed to meet the
- demands of class 8 vehicles, and
- therefore has fewer upgrades
 - Solo
 - eliminate manual adjustments
 - maintain constant clutch performance
 - Increased facing area
 - from 4 pad Super Buttons to 6 pad
 - Increase plate load
 - increases clutch reserve factor (will increase pedal effort slightly)



Select another topic, or Esc to Quit

ENGINEERING UPDATE

Product Improvements and Extensions
on Easy Pedal and Solo Clutches



Easy Pedal 2000

- The next generation 15.5" Easy Pedal platform - introduced in August 1999 and fully interchangeable with all current Easy Pedal Plus 15.5" Clutches
- Employs features successfully used in existing Eaton clutch products;
 - **Power-thread** used in U.K. since 1991
 - **Strap-driven Pressure plate** used in N. A., on the Solo clutch, since 1997
- These features have added considerable value to the Easy Pedal product without an increase in cost.

EP 2000 Advantages

- Improved adjustment
 - To adjust the release bearing position by **1/8"**, rotate the **Kwik-adjust**;
 - = **2²/₃ turns (or 8 clicks) for the old thread**
 - = **1 turn (or 6 clicks) for the new Powerthread**
 - Additional thread clearance now eliminates the chance of seizure
- Reduced vibration
 - The strap drive pressure plate eliminates the vibrations common with the lug drive system found on the current Easy Pedal

Easy Pedal 2000

Strap Driven Pressure Plate

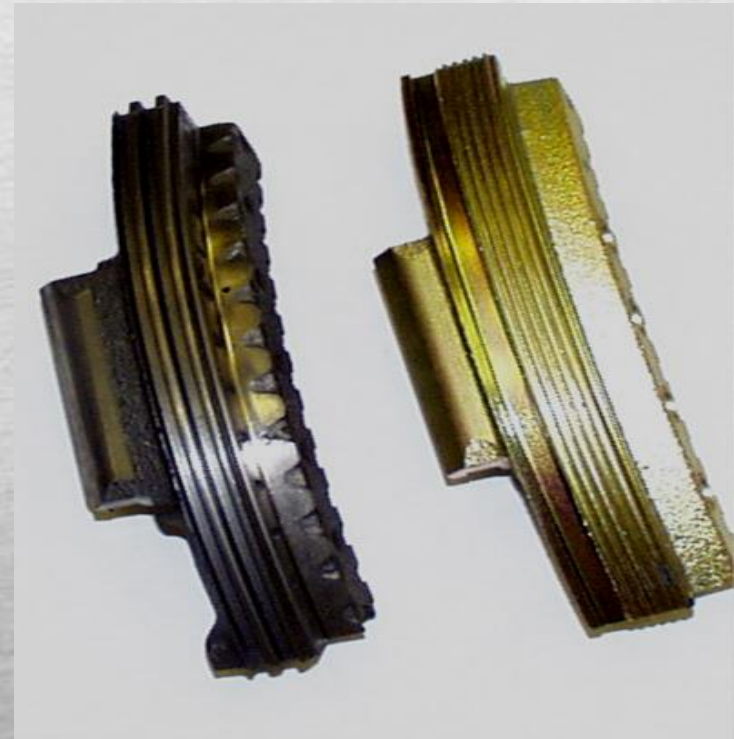
Reduces Noise and Vibration while Improving Clutch Assembly Balance, compared to Lug Driven Pressure Plate



Easy Pedal 2000

New Robust Thread Design

- Coarser thread loosens more easily than fine thread allowing for quicker adjustment
- Reduces possibility of cross threading

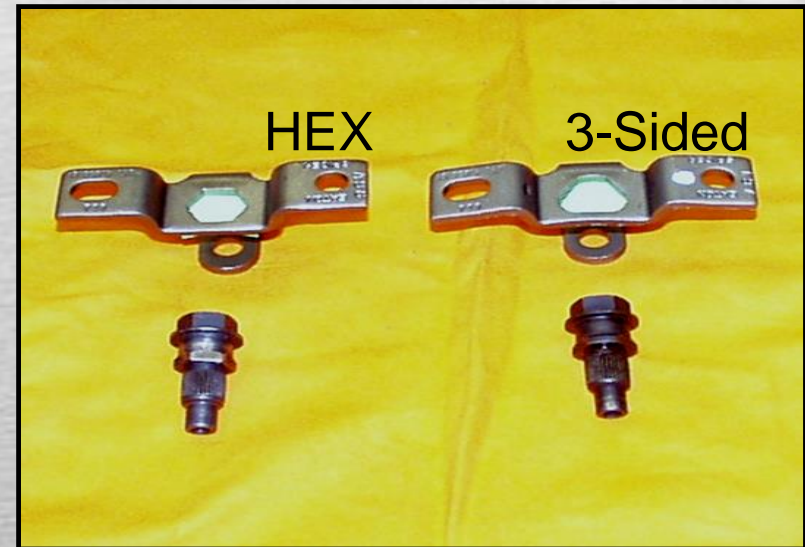


Easy Pedal 2000

New Improved Kwik-Adjust

Features

- 6 Point Hex Head
- Maintains Fine Adjustment for Bearing Position
- Allows for quick Clutch Adjustment
- Up to 75% Stronger and more Durable

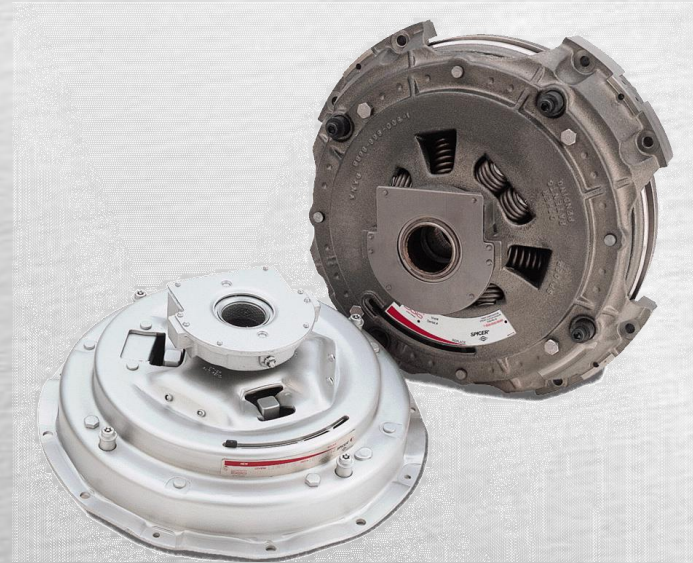


Eaton Fuller Solo

Product Improvements



**THE CLUTCH THAT THINKS
IT'S A MECHANIC.**

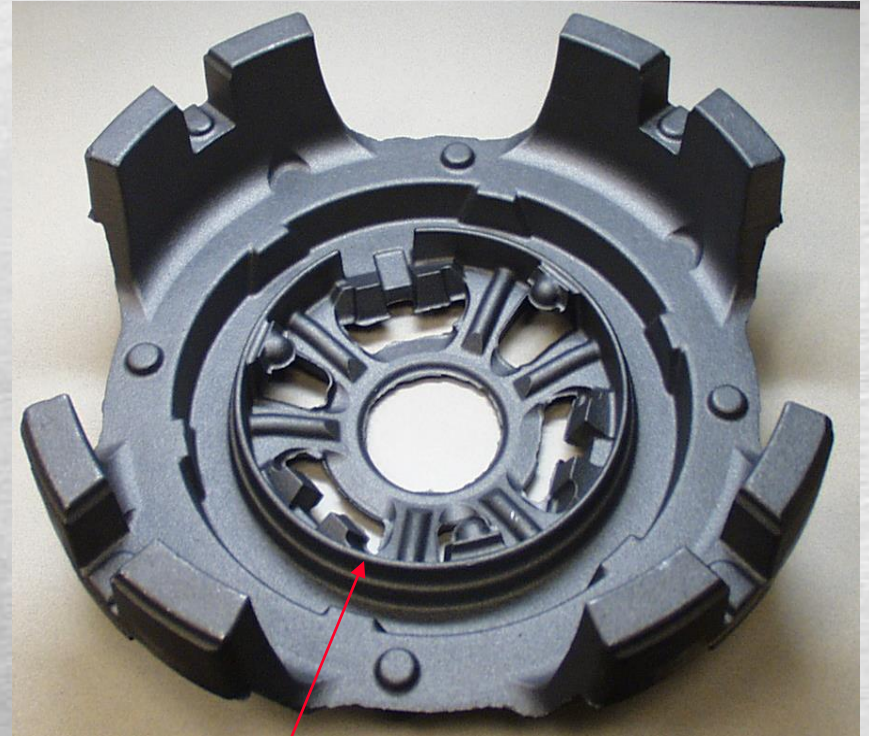


Heavy Duty Solo Baffle

Baffle has been added on HD Solos to block debris and prevent cam bore contamination (which prevents the cams from sliding)

Introduced 3/23/00

(Baffle design also present on EP 2000)



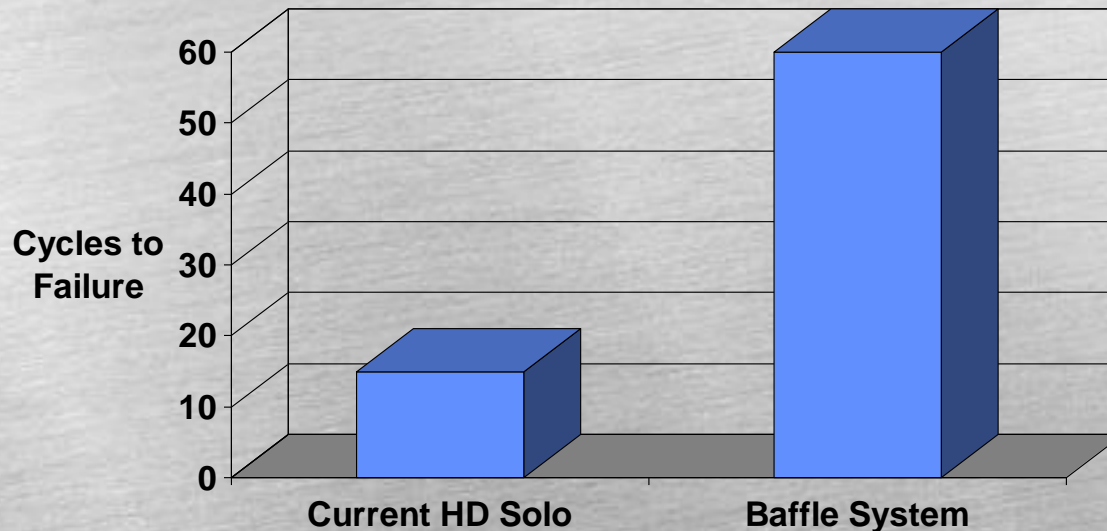
Baffle

HD Solo Baffle - Lab Testing

Special contamination test was developed

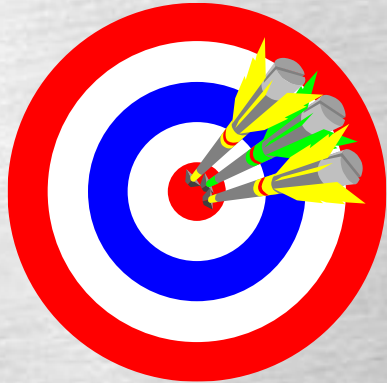
- Arizona dust and moisture
- Temperature 275F
- 10 grams per cycle

No Failure



Eaton Fuller Solo XL

with Extended Lube Option



Heavy-Duty

- Adjustment Free
- Longer Life
- Extended Lube Interval
- Soft Rate Dampers

HD Solo - XL

Design Features / Competitive Advantages



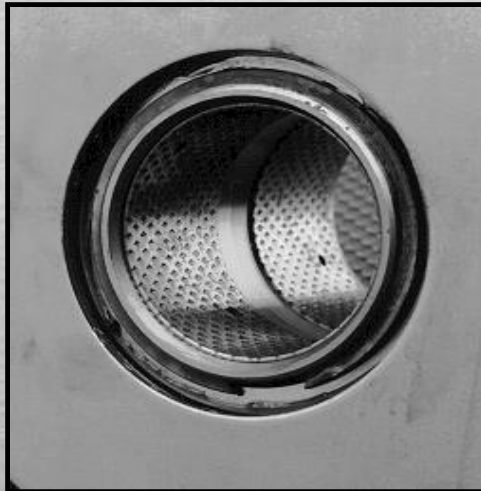
- Adjustment-Free Clutch
- Roller Yoke System for Extended Life
- Sealed, Premium Ball Bearing
- Improved Steel Backed Bushing Material
- Two Bushings vs. One
- Lube Reservoirs for Bushing Area

Solo XL

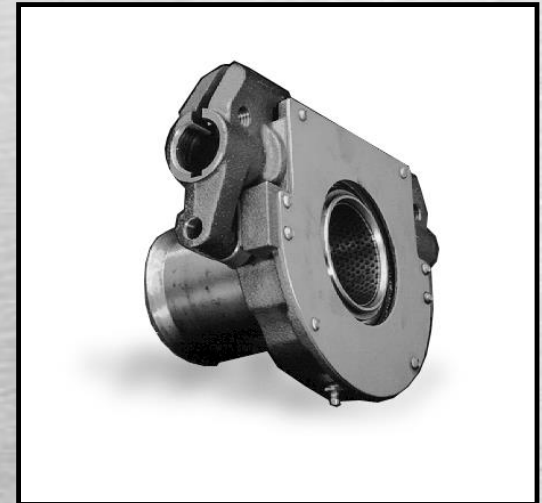
Roller Yoke



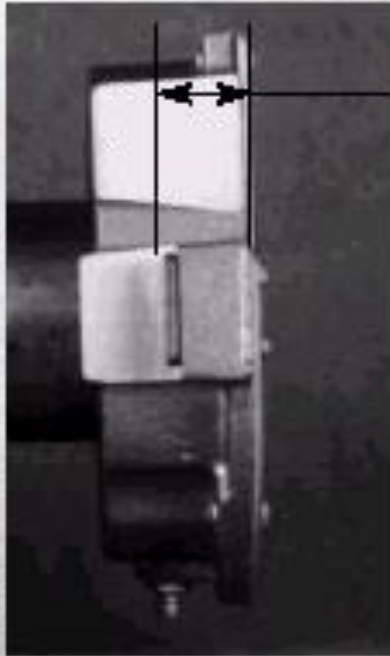
Improved Steel backed Bushings



Premium Sealed Ball Bearing



Release Bearing Differences

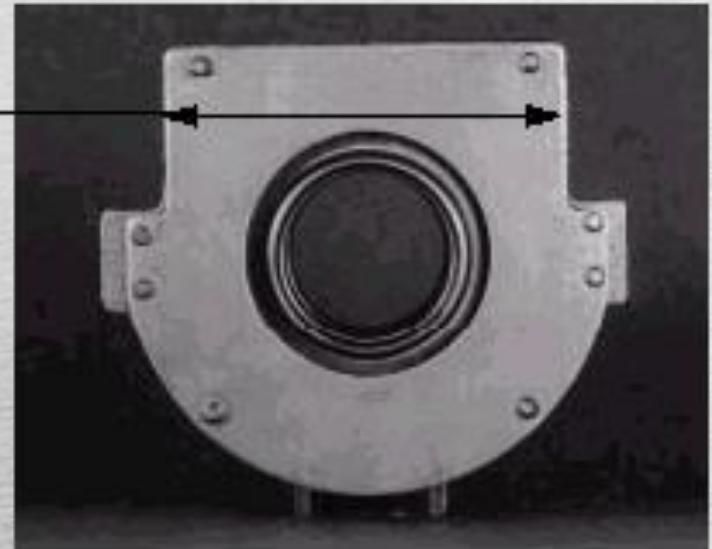


Distance of thrust pad to bearing cap for Solo XL = .837" (shown)

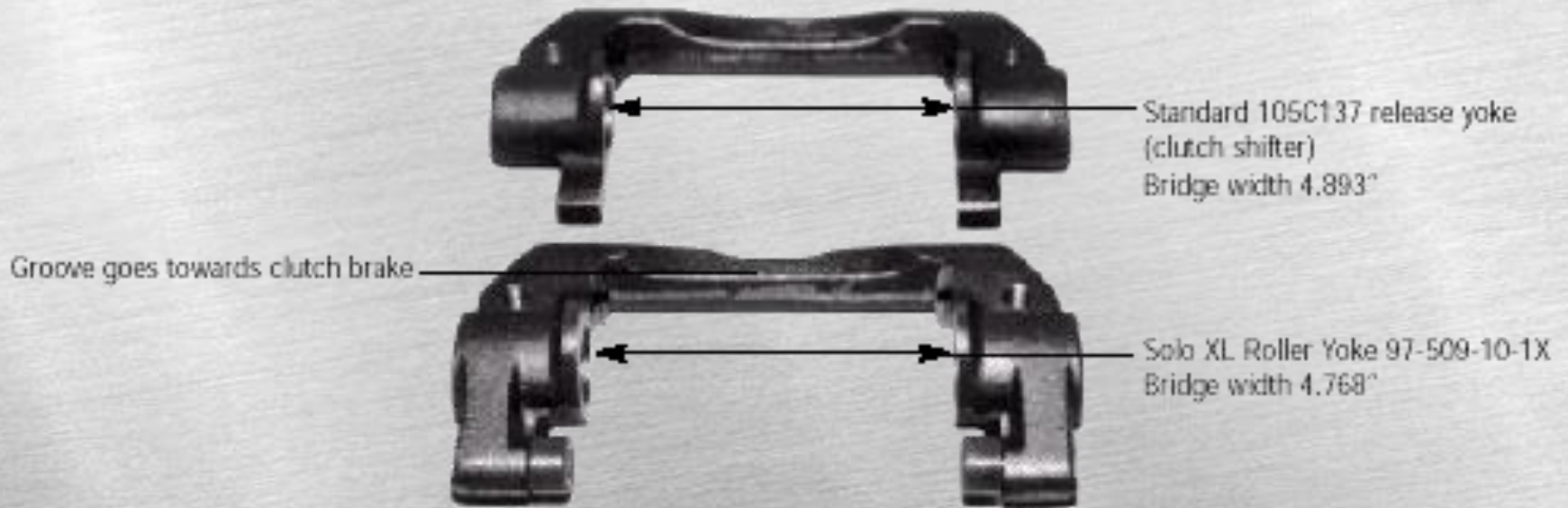
Width of bearing housing for Solo XL - 4.750" (shown)

Standard bearing housing - 4.875"

Standard bearing housing = 1.062"



Roller Yoke Differences

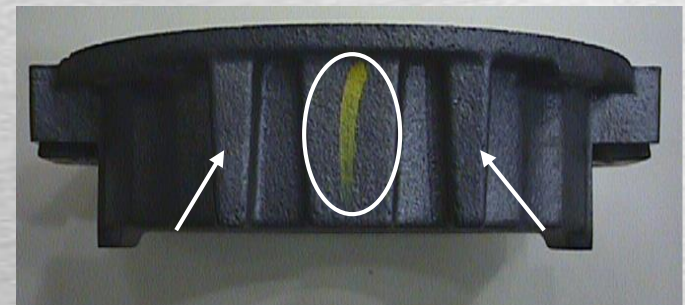
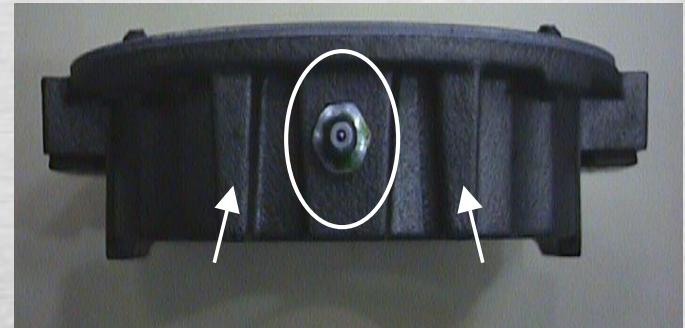


Roller Yoke Utilization



Roller yoke is used with Solo Extended Lube (XL) and Solo Maintenance Free clutches. This release yoke can only be used with these two release bearing housings.

The XL release bearing has a grease zerk and is identified by the two webs on the housing



The MF bearing housing does not have a grease zerk but it does have the two identifying webs.

Eaton Fuller Solo

Maintenance-Free Clutches



The clutch you simply FIT and FORGET

Solo MF

Now we've eliminated periodic lubrication requirements - a first for the North American market

- All the benefits of the Adjustment-Free Solo
- Never needs lubrication for the life of the clutch
- Product enhancements maximize service life

Both Medium and Heavy Duty models currently available

Medium - Duty



Heavy - Duty

MD Solo - MF

Maintenance-Free Solo Advances

- Wider bushings with lube reservoirs to retain lubrication
- Clutch release yoke with rollers
- Eliminates vertical loading that can cause wear of bearing, bushings and input shaft
- Reduces pedal effort



Solo MF Identification



Same as standard medium duty Solo except:

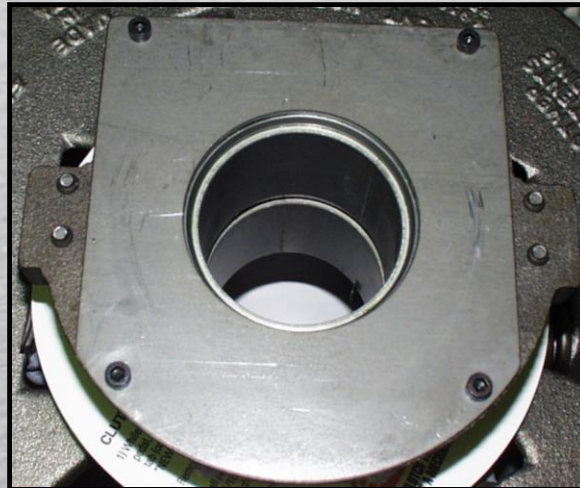
- Two-piece retainer/ steel - backed bushing
- Roller yoke
- Roller yoke bearing housing has cast-in ribs (same as Solo XL)

Heavy Duty Solo - MF

Roller Yoke eliminates vertical loading that can cause wear of bearing, bushing, and input shaft

- Composite bushing
- Premium permanently lubed release bearing

Input shaft sleeve to protect bushings and shaft from wear (required with clutch)



HD Solo MF Identification



Same as Standard HD Solo except:

- No grease zerk
- Input shaft sleeve
- Composite bushing (not bronze)
- Roller yoke

HD Solo - 2250 ft.-lb.

- Increased rating of 2250 ft.-lb. to complement new Eaton RTLO/FR-22918B transmission,
- V.C.T. Damper with 2" 14 tooth, involute spline, inner hub for compatibility with stronger transmission input shaft
- XL version released in January 2000

Clutch Installation Highlights

Part Number 109706-22 (SOLO XL)

Cover Assembly	139032-6	4000 lb. PL, special plate concavity for 2250 lb. ft. rating
Driven Disc Front	128654	New damper rated to 2250 ft-lb. V.C.T. – 6 paddle ceramic
Driven Disc Rear	128654	New damper rated to 2250 ft-lb. V.C.T. – 6 paddle ceramic
Inner Hub Assembly	125500	2 inch 14 tooth involute input spline
Intermediate Plate & Pin Assembly	125491	Increased plate concavity .012" vs .002"
Roller Yoke	97-509-10-1X	No Change
Clutch Brake	127760	No Change

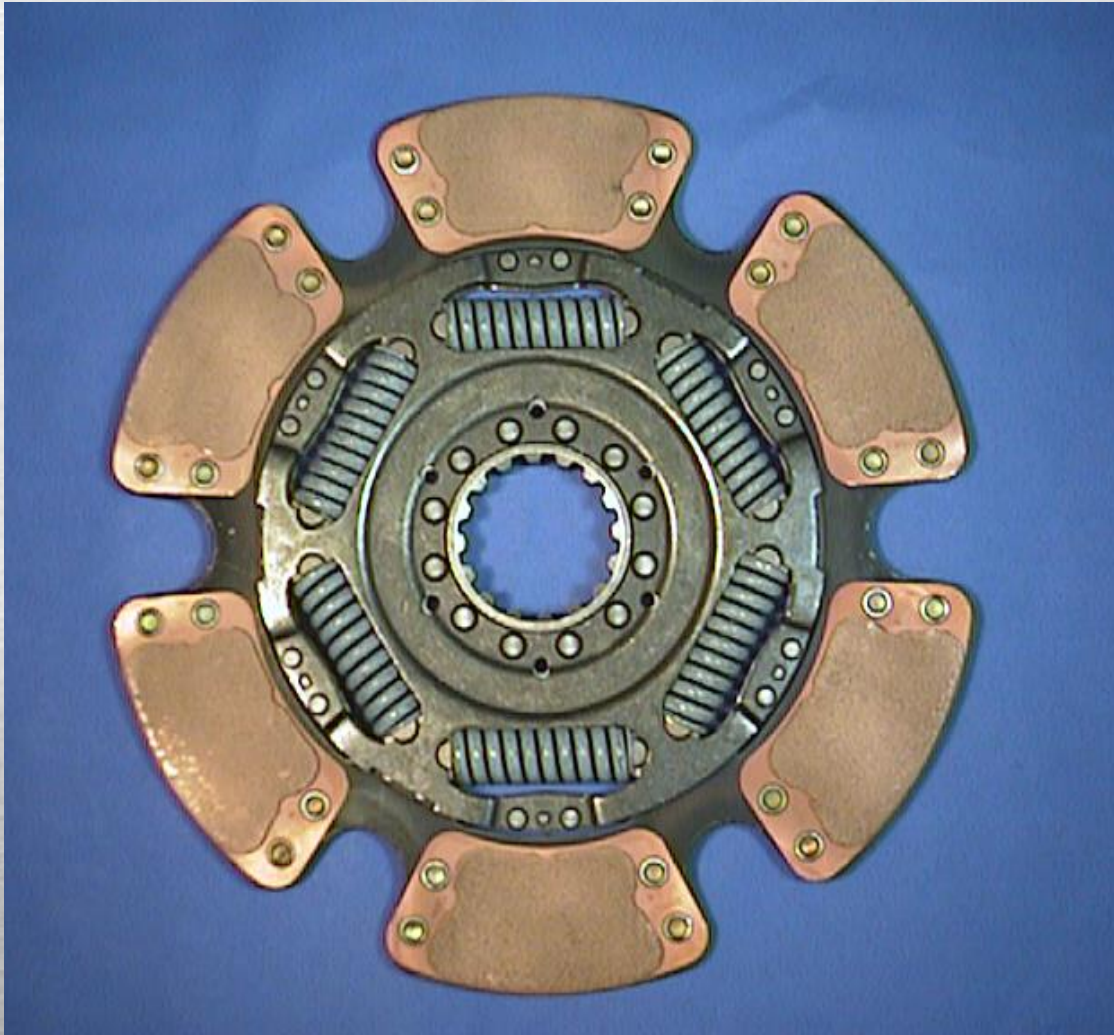
2250 ft.-lb. - Cover Assembly



2250 ft.-lb. - Intermediate Plate



2250 ft.-lb. - Driven Disc Assembly

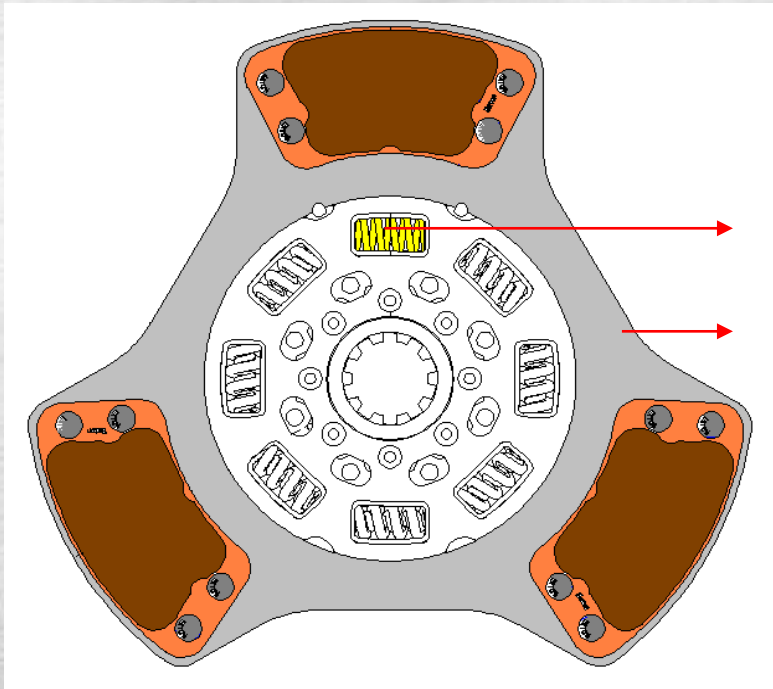


7+1 Damper

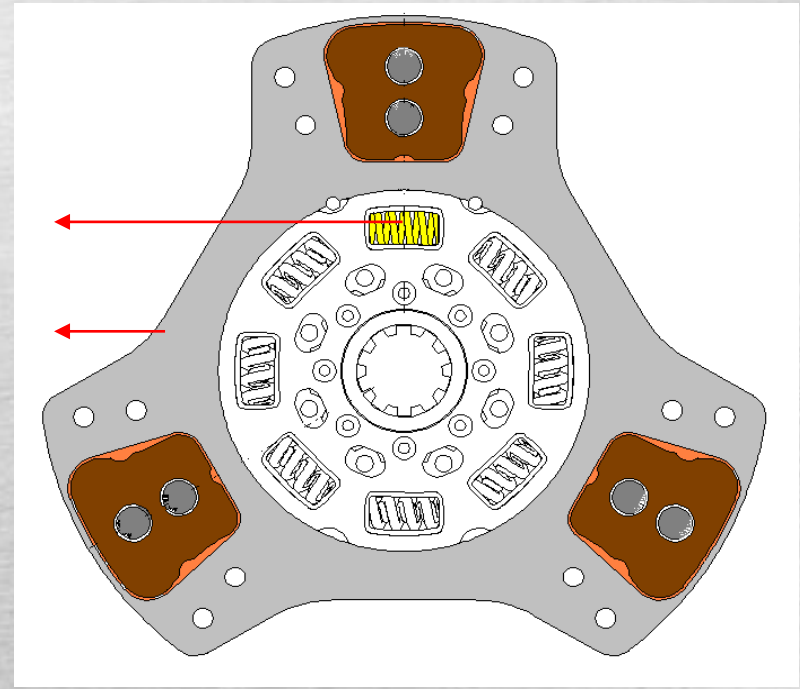
- Eaton Clutch Division has developed a new damper to simultaneously resolve the issues of both idle rattle and drive rattle.
- The “**7+1 Damper**” incorporates the benefits of both free travel and soft rate dampers in one single design, and thereby eliminates the limitations of either style of damper.
- Further, the pre-damper stage in the new design is spring-loaded and thereby provides a dampening effect even at idle speeds / torque.

Visual Identification of 7+1 Disc

3 Super Button



3 Super Trap



1. One yellow spring provides the required dampening during the pre-damper travel stage
2. Common disc to minimize development and manufacturing costs

7+1 Disc Availability

- Introduced - July 2001
- Available in
 - SAS 1402
 - Solo 1402
 - rated up to 860 ft.-lb.
 - 1.75" and 2.00" spline
- Supersedes all 2-plate installations
 - rated up to 860 ft.-lb.
 - using 8-spring low rate damper

Select another topic, or Esc to Quit