LIEBHERR-AEROSPACE

LINDENBERG

Airbus / A350
Nose Landing Gear Training

Level III

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EFFECTIVITY:

ALL

03 Dec 2014

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LIST OF ABBREVIATIONS (LOA)

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LIST OF ABBREVIATIONS

A	
A/C	Aircraft
ACC	Accumulator
ACV	Anti-Cavitation Valve
AL	Accumulator Line
ASV	Anti-Shimmy-Valve
ASSY	Assembly
B	
BCS	Brakes and Steering Control System
C	
C1	Chamber 1
C2	Chamber 2
COV	Change Over Valve
F	
FI	Filter
FOD	Foreign Object Damage
H	
HVOF	High Velocity Oxygen Fuel
HMV	Major Maintenance Overhaul
L	
LDS	Lower Drag Stay
LLI	Liebherr-Aerospace Lindenberg GmbH
LH	Left Hand
LEP	List of Effective Pages
LLV	Load Limiting Valve
LOA	List of Abbreviations
LGMS	Landing Gear Monitoring System
LHL	Left Hand Line
LS	Lower Stay
M	
MV	Maintenance Valve
MRV	Maximum Ramp Weight
N	
NLG	Nose Landing Gear
NWS	Nose Wheel Steering

NWSHCB	Nose Wheel Steering Hydraulic Control Block

O

OAT	Outside Air Temperature

P

PROXY	Proximity Sensor

R

RCV	Return Check Valve
RH	Right Hand
RHL	Right Hand Line
RVDT	Rotary Variable Differential Transducer
RSV	Rotating Selector Valve Assembly
RRV	Return Relief Valve

S

SAT	Shock Absorber Travel
SCS	Steering Control System
SCV	Supply Check Valve
SCOV	Steering Change Over Valve
SEV	Steering Enable Valve
SL	Supply Line
SSL	Servo Supply Line
SSCV	Servo Supply Check Valve
SSOV	Steering Shut Off Valve
SHB	Steering Hydraulic Block
STD	Standard

T

TOC	Table Of Content

W

WOW	Weight On Wheels
WOFFW	Weight Off Wheels

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Introduction

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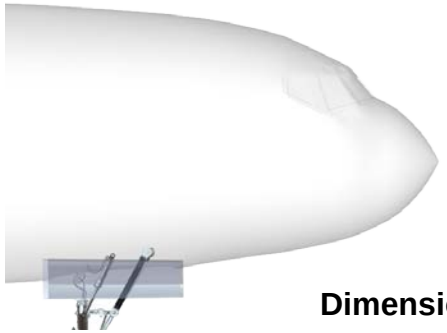
INTRODUCTION

The NLG support the aircraft on the ground, dissipate landing energy and transmit loads to the airframe.

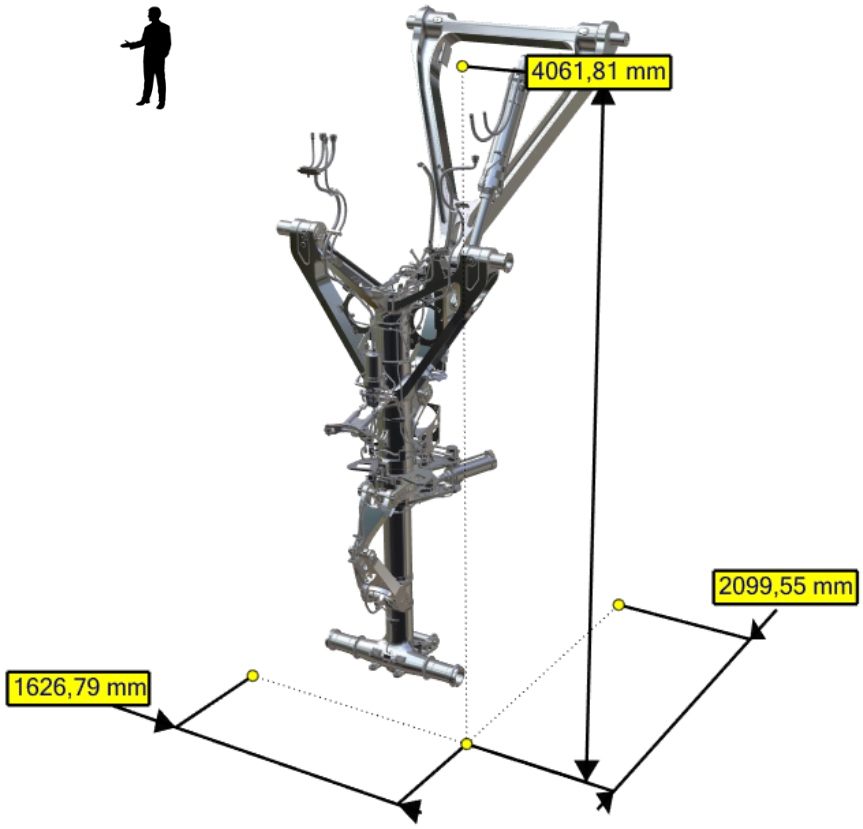
The NLG is mounted via support structure on the Rear Spar and Gear Beam. The NLG is mounted in the forward fuselage, on the centerline of the aircraft. All Landing Gear bays are enclosed by doors.

Control of the direction of the aircraft on the ground is achieved by Nose Wheel Steering (NWS). The NWS is controlled by means of the hydraulically powered and eletrically controlled by Steering Feedback Units (Not LLI responsibility).

The NLG has two wheels and a steering motor attached to the telescopic shock strut that absorbs the landing impacts and the aircraft weight during taxiing and ground handling. The NLG is attached to the aircraft fuselage near the forward end. During retraction, the NLG moves forward and up into the wheel-well by means of a hydraulic actuator and is completely closed by four doors when retracted.

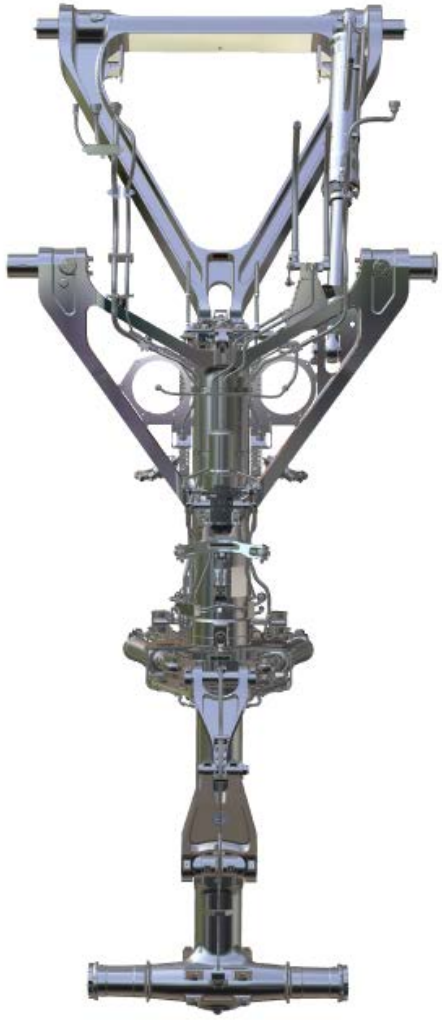


Dimensions



Front View

Back View



SHOCK STRUT

The shock strut supports the forward fuselage while the aircraft is on ground. The shock strut has:

- Main fitting
- Sliding Tube with integrated Axle Assembly
- Steering Mechanism
- Torque Links
- Sensors
- Steering Shut Off Valves
- Nose Wheel Steering Hydraulic Control Block
- Steering Change Over Valve
- Change Over Valve (From Main to Spare Seal)

The main fitting and the sliding tube together operate as a spring and damper, or shock absorber. The shock absorber reacts to loads and aircraft movement resulting from:

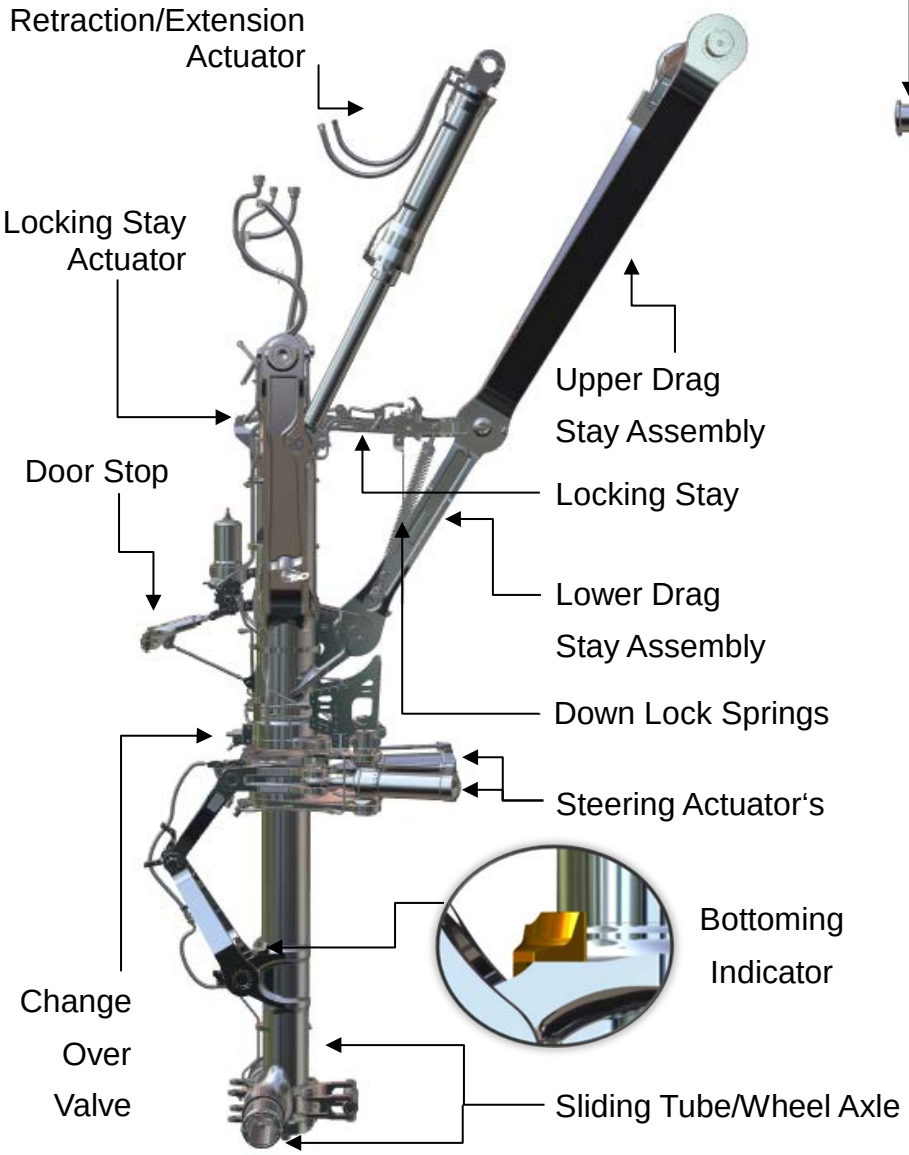
- Take-off
- Landing
- Taxiing

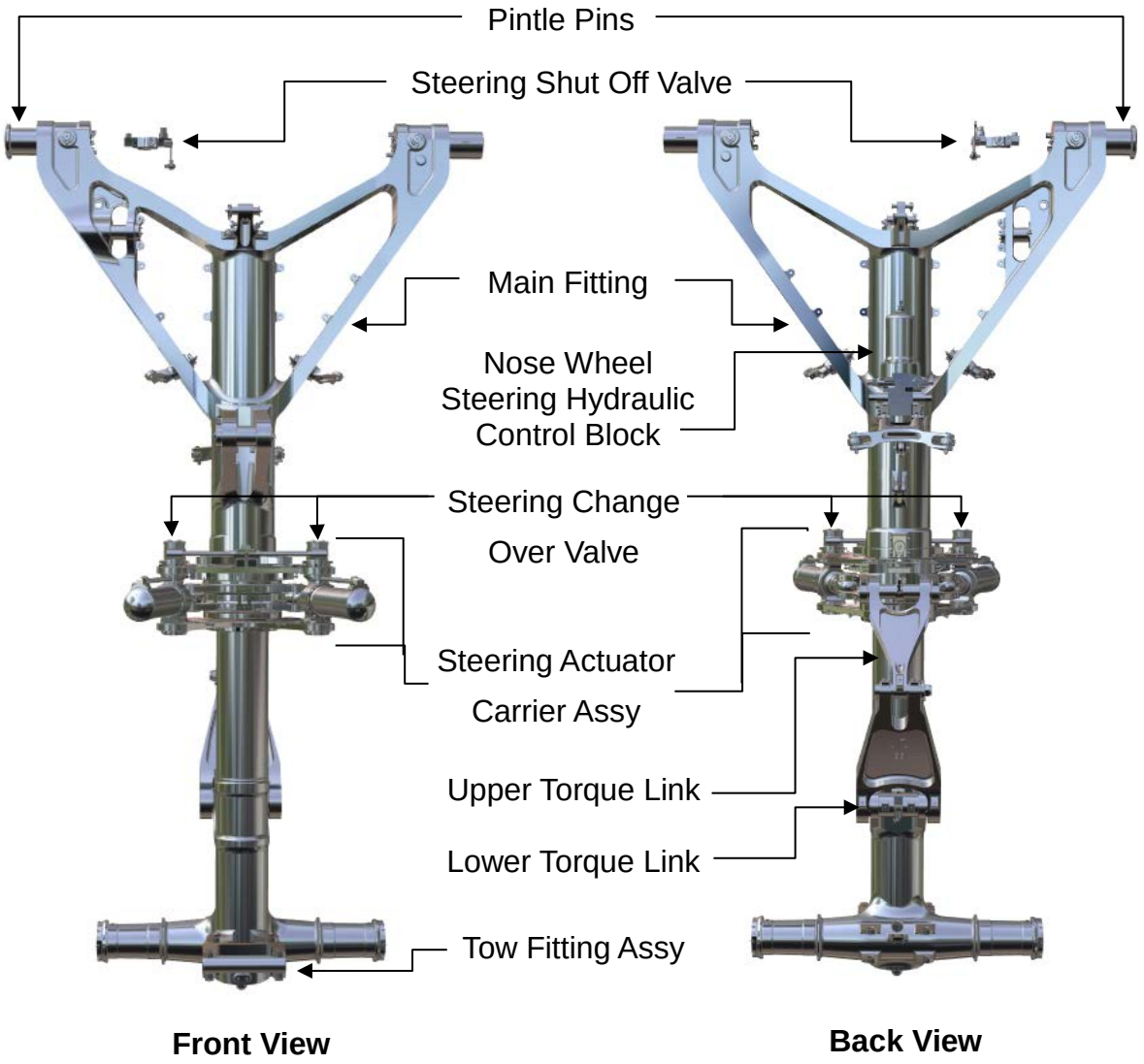
The steering mechanism turns the sliding tube and axle assembly for NLG steering on the ground. There are centering cams on the sliding tube and main fitting which hold the NLG steering in the 0^{o} position whenever the aircraft is not on ground.

Proximity sensors and feedback sensors transmit the following signals to the Landing Gear Monitoring System (LGMS) and the Steering Control System (SCS).

- NLG down and locked (LGMS)
- A/C on ground (weight on wheels signal) (LGMS)
- NLG Steering Angle (SCS)

Forward and Aft loads are reacted via a Drag Brace assembly which is locked in the down position via a Lock Link assembly and two Downlock Springs. The Lock Links are held over-centre against a stop pad by dual tension Downlock Springs. For NLG retraction, the Lock Links are unlocked via the Downlock Release Actuator. The Lock Links have provision for “downlock” sensing and also provide a location for the “Ground Lock Pin”.To provide the optimum characteristics for landing and taxiing, the Shock Absorber design incorporates a Metering Pin for instroke damping. Recoil damping is provided by a recoil flapper orifice and chamber.The axle is positioned aft of the Sliding Tube axis so that when the wheels are free to castor without steering system hydraulic pressure, the geometry allows the wheels to stay centered while moving forward. During Shock Absorber compression the Centering Cams disengage allowing the push-pull Steering Actuator to rotate and steer the NLG. This therefore allows ground maneuvering during taxi and landing.

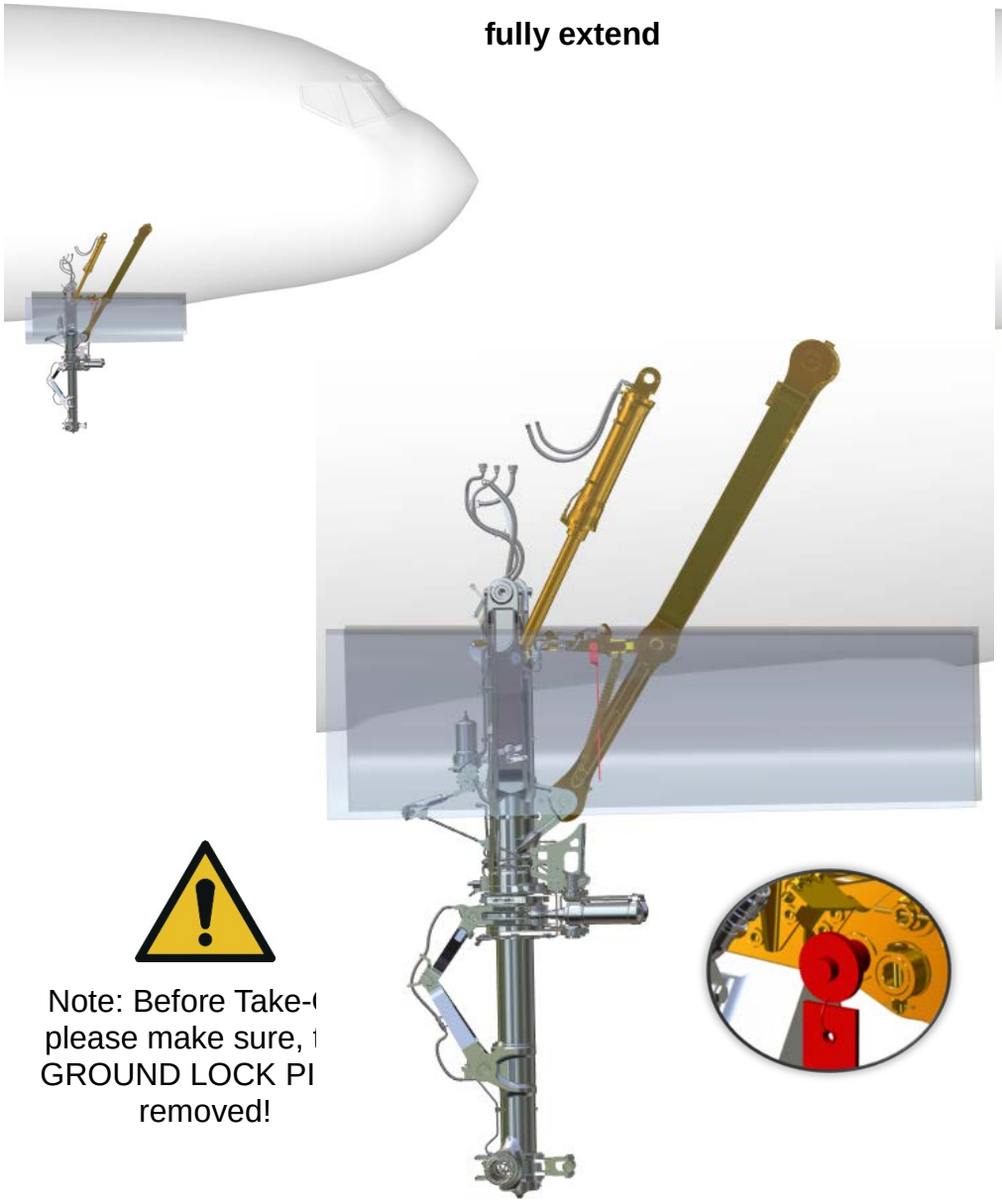

Retraction/Extension Actuator
Locking Stay Actuator
Door Stop
Upper Drag Stay Assembly
Locking Stay
Lower Drag Stay Assembly
Down Lock Springs
Steering Actuator‘s
Bottoming Indicator
Change Over Valve
Sliding Tube/Wheel Axle


Pintle Pins
Steering Shut Off Valve
Main Fitting
Nose Wheel Steering Hydraulic Control Block
Steering Change Over Valve
Steering Actuator Carrier Assy
Upper Torque Link
Lower Torque Link
Tow Fitting Assy
Front View
Back View

EXTENSION AND RETRACTION

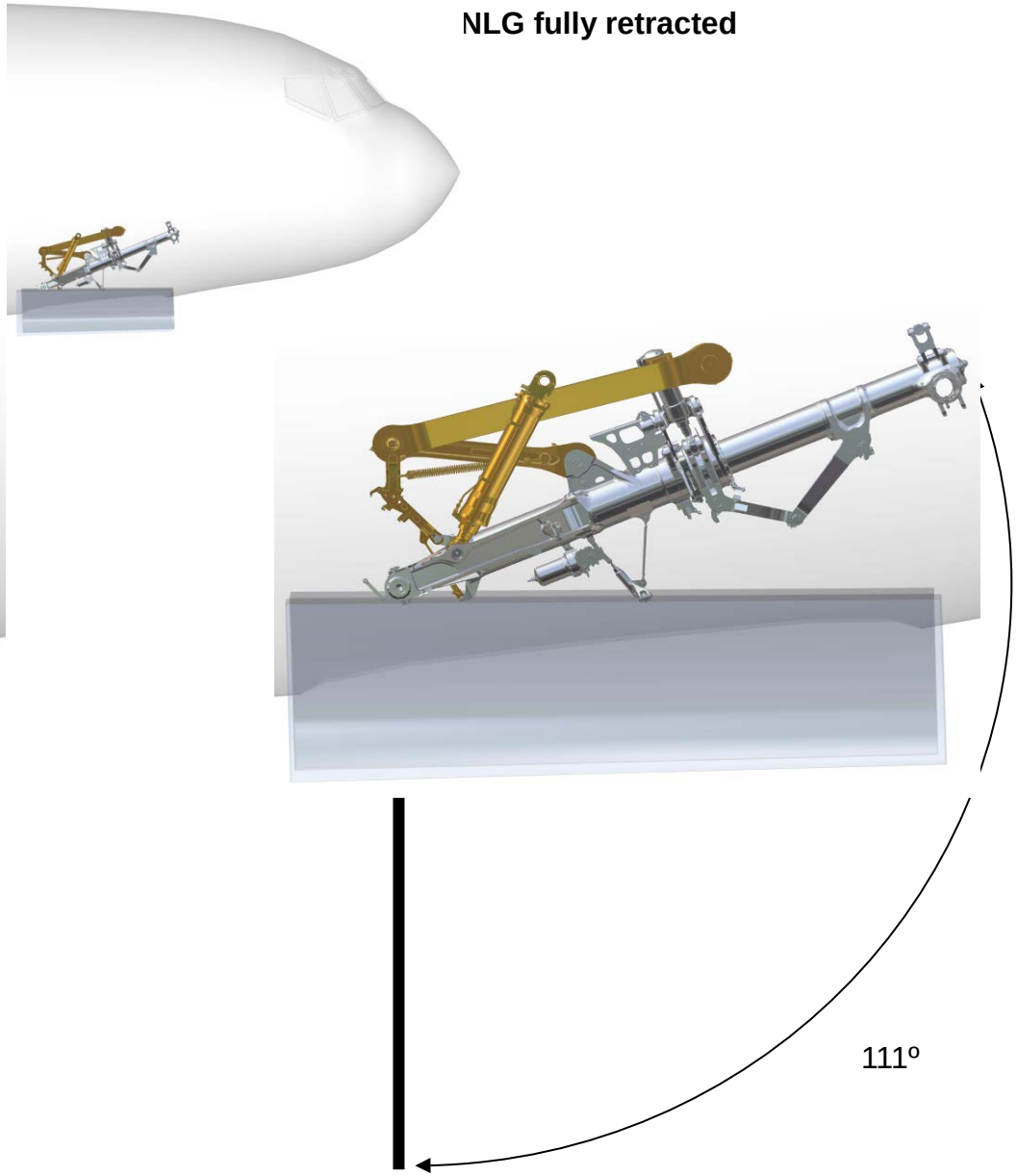
In the down and extended position the NLG shock strut is supported by a foldable drag brace. A locking mechanism composed by a lock link, a pair of locking springs and an unlock actuator holds the gear in the fully extended and locked position. In the down and locked position the unlock actuator and retraction actuator remain pressurized.
In the up and retracted position the NLG shock strut remains locked by the lock link and locking springs. The NLG subsystems is locked when the lock link is in the overcentered position.

fully extend



Note: Before Take-
please make sure,
GROUND LOCK PI
removed!

NLG fully retracted



P/N	CODE	DESCRIPTION	QPA	REMARKS
4584A0000	**NLG**	**Nose Landing Gear + Subsystem**	**1**	**Complete NLG System**
4808A0000		Upper Drag Stay Assy	1	1 per NLG
4810A0000		Retraction Actuator Assy	1	1 per NLG
5310A0000	NLG Complete	Nose Landing Gear Compete (without subsystem)	1	1 per NLG
4816A0000		Nose Landing Gear Shock Strut Assy	1	1 per NLG
4866A0000		Locking Stay Actuator	1	1 per NLG
4817A0000		Steering Actuator	2	2 per NLG
4818A0000		Steering Change Over Valve	2	2 per NLG
4815A0000		Nose Wheel Steering Control Block	1	1 per NLG
4813A0000		Steering Shut Off Valve	1	1 per NLG
5312A0000		Lower Drag Stay Assy	1	1 per NLG
4811A0000		Lock Stay Assy	1	1 per NLG
4812A0000		Downlock Spring	2	2 per NLG

4816A9000		**Parts Set Electr. - Hydr.**	**1**	**1 per NLG**
4816A9111		1M Upper Electrical Harness	1	1 per NLG
4816A9112		1M Lower Electrical Harness	1	1 per NLG
4816A9121		2M Electrical Harness	1	1 per NLG
4816A9131		1R Electrical Harness	1	1 per NLG

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Greasing Points

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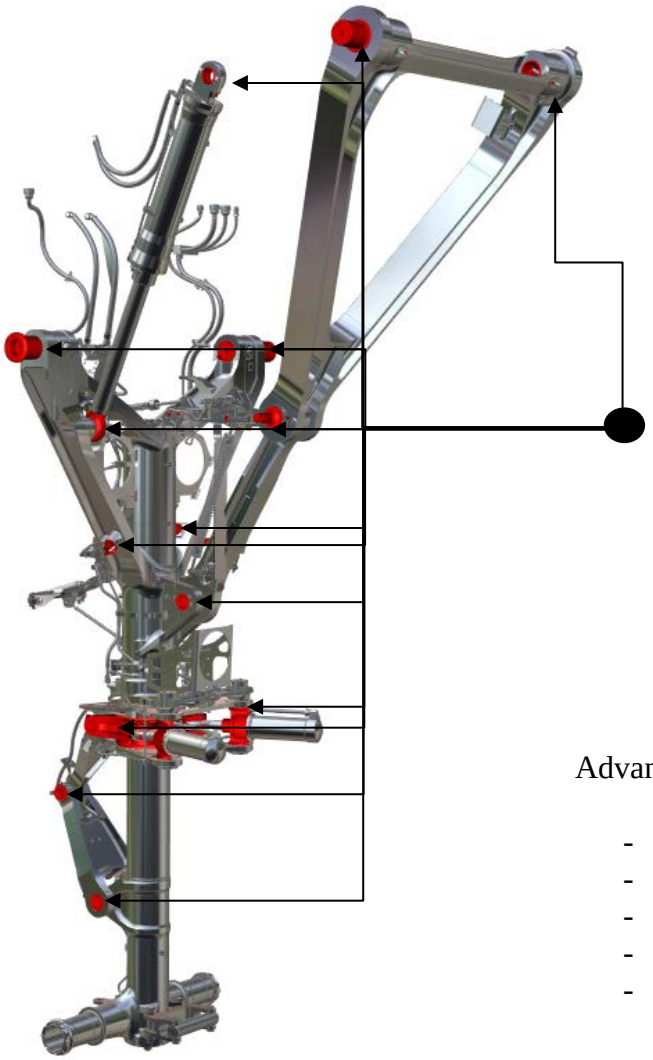
The NLG lubrication shall use lithium complex thickened GP grease Aeroshell 33 (MIL-PRF-23827C) for operating temperature range -73º to +120º .

All static and dynamic joints at the NLG containing bolt diameter larger 20mm bolt diameter will be designed for grease lubrication.

For smaller bolt designs self lubricated bushes will be selected.

Standart (STD) or specific grease guns, tolls and couplings are used for the A350 NLG greasing.

LLI has loacted each grease fitting to allow access with STD industry tolling. However, in a minory of cases, it may be necessary to use a 90º or 45º adaptor on the grease gun due to the steering or retraction angle when in service. The use of these fittings is already a standardized maintenance procedure and LLI can foresee no specific problems.



Grease Gun

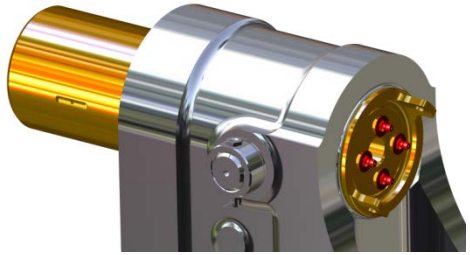
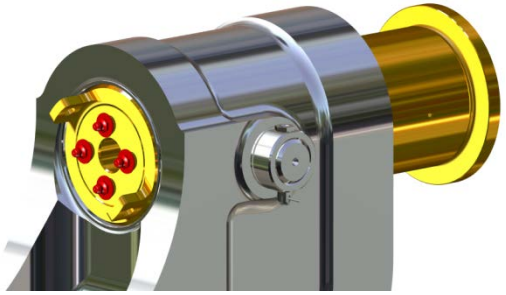
Grease

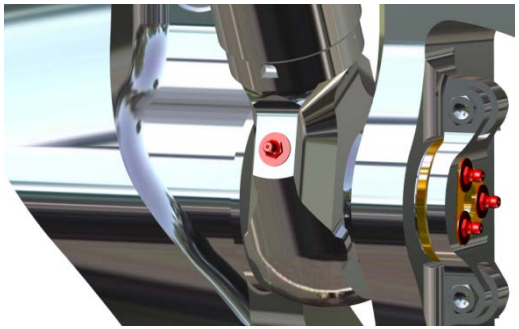
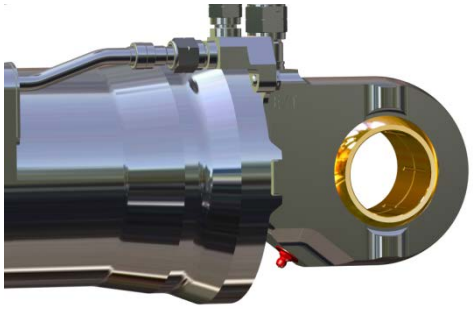
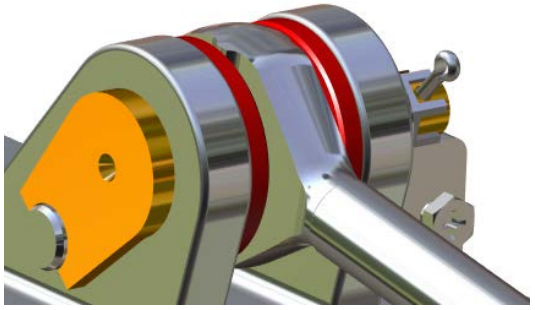
GRIP 360º Grease Gun Coupler

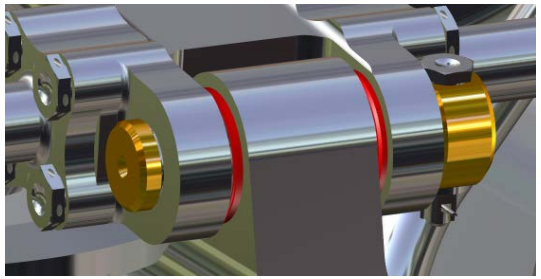
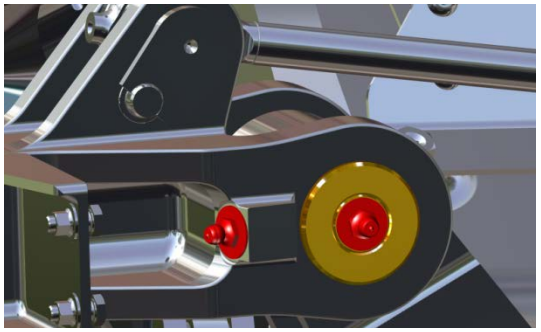
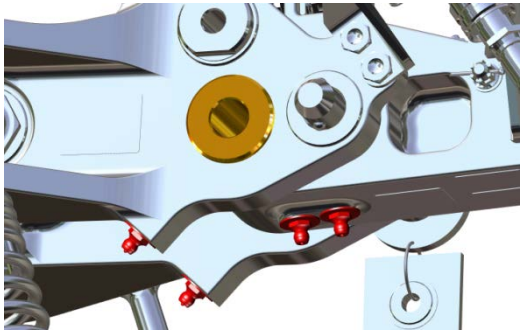
Advantages:

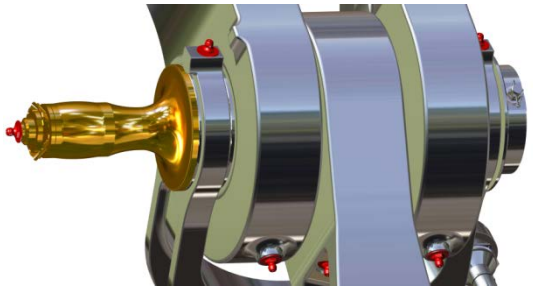
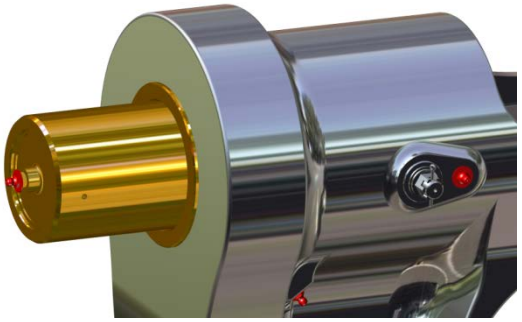
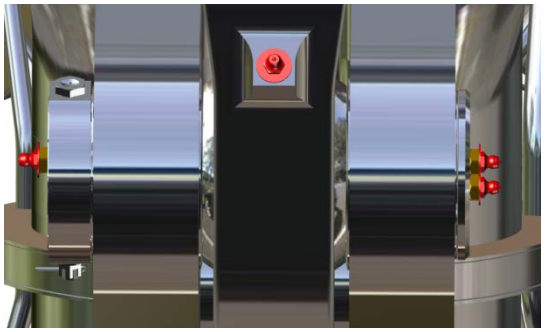
- Avoid high stress concentrations in the components that could lead to fatigue failure
- Maximize protection against corrosion
- Minimize contamination of joints
- Maximize the structural integrity of the joints
- Minimize wear

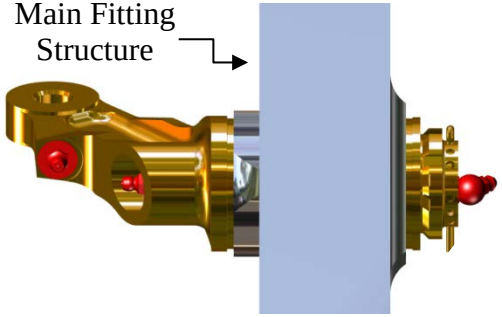
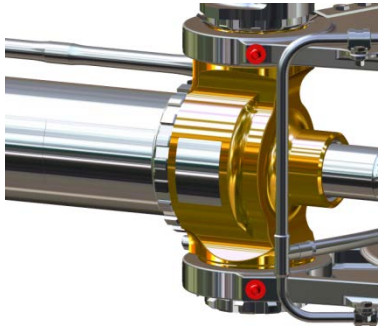
LIST OF GREASED JOINTS

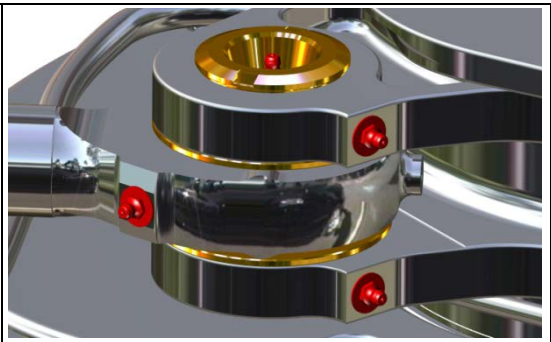
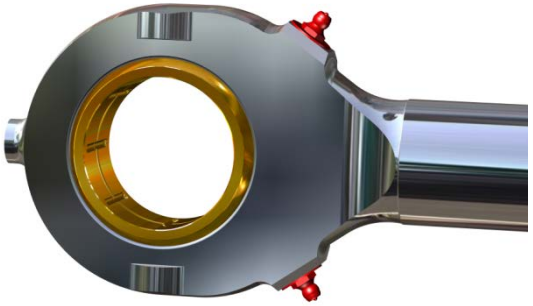
Ref. Number	Description		Notes	Page Nº
1.1	Pintle Pin LH (cantilever joint)			11-13
1.2	Pintle Pin RH (cantilever joint)			14-16
1.3	Retraction actuator rod end – spherical bearing (ball surfaces)		(applicable to rod and head end)	17

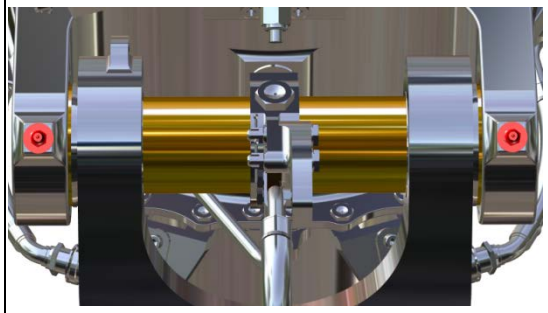
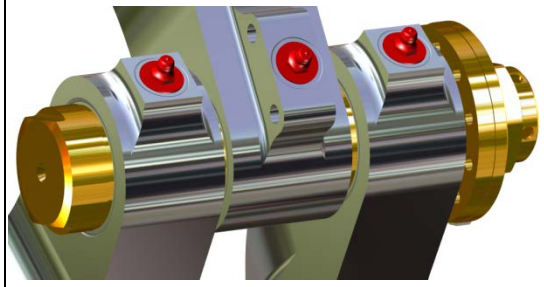
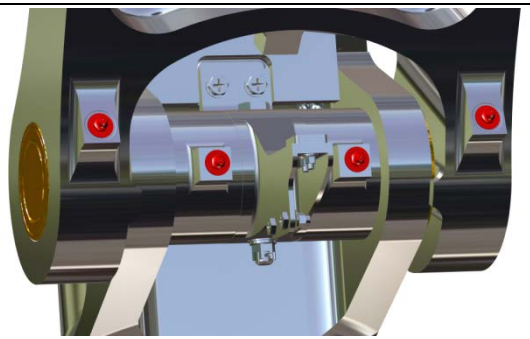
1.4	Retraction actuator rod end (bore to pin)			18-20
1.5	Retraction actuator head end (bore to pin)			21
1.6	Unlock actuator rod end (bore to pin)			22

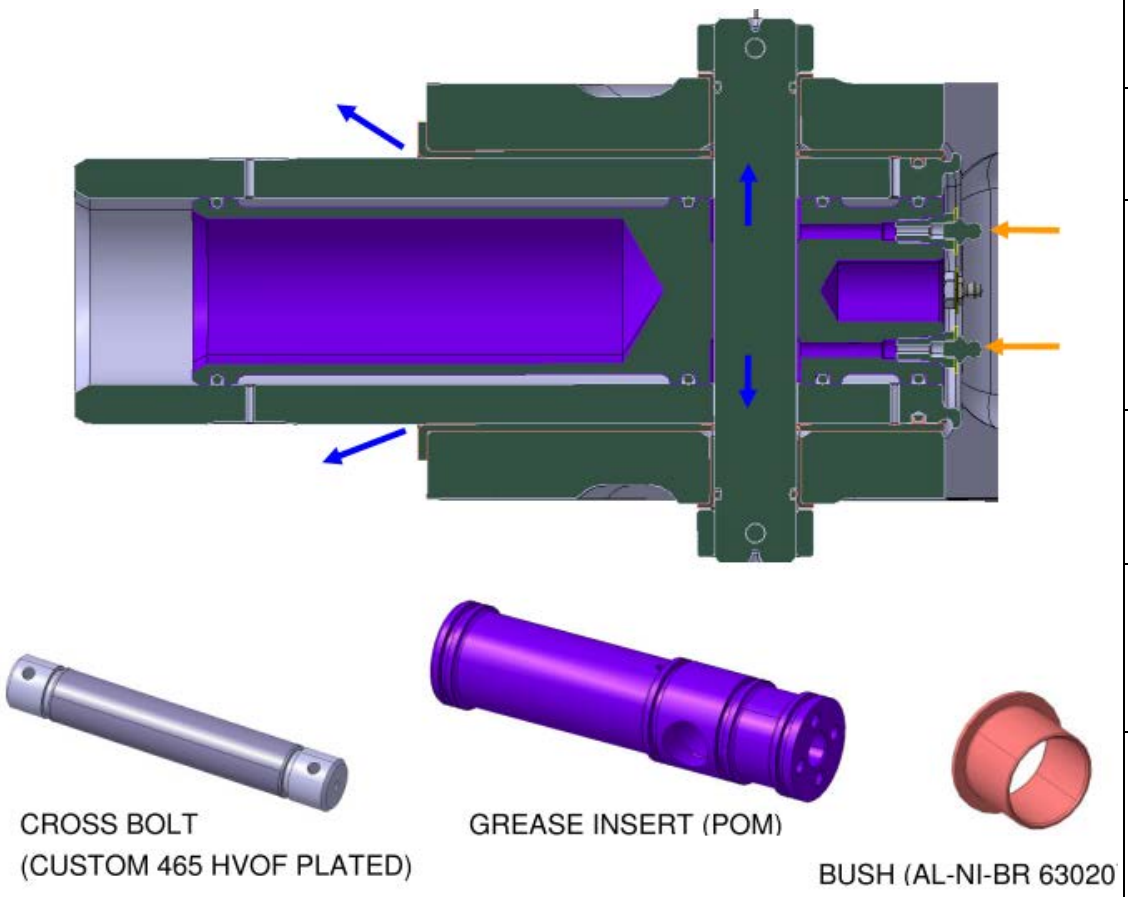
1.7	Unlock actuator head end			23
1.8	Upper locking stay to main fitting (Static and Dynamic)			24-25
1.9	Lower to upper locking stay (Static and Dynamic)		LS Apex Bolt	26-27

2.0	Apex Pin - Upper drag stay to pin - Lower drag stay to pin - Lower lock link to pin - Up-lock roller bearing			28-31
2.1	Upper Drag stay Pintle pin (Static and Dynamic)		Typical LH and RH	32-34
2.2	Lower Drag stay pin		LDS to MF	35-36

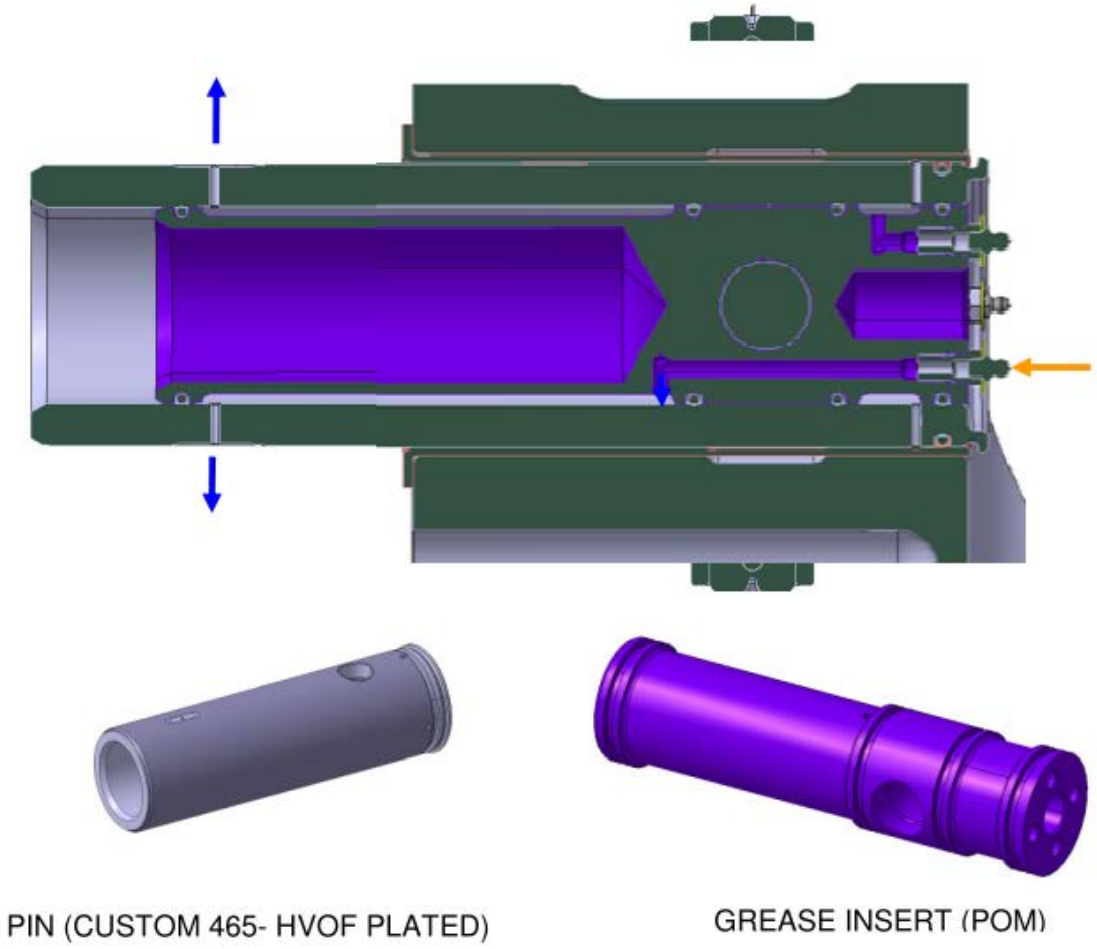
2.3	Lower Drag stay bearing			37
2.4	Cardan pin		Typical LH and RH	38
2.5	Upper and lower steering plate		Steering Actuator attachment Typical LH and RH	39

2.6	Steering actuator pin to cuff			40-41
2.7	Swaged bearing steering pin			42
2.8	Steering cuff bushes			43-44

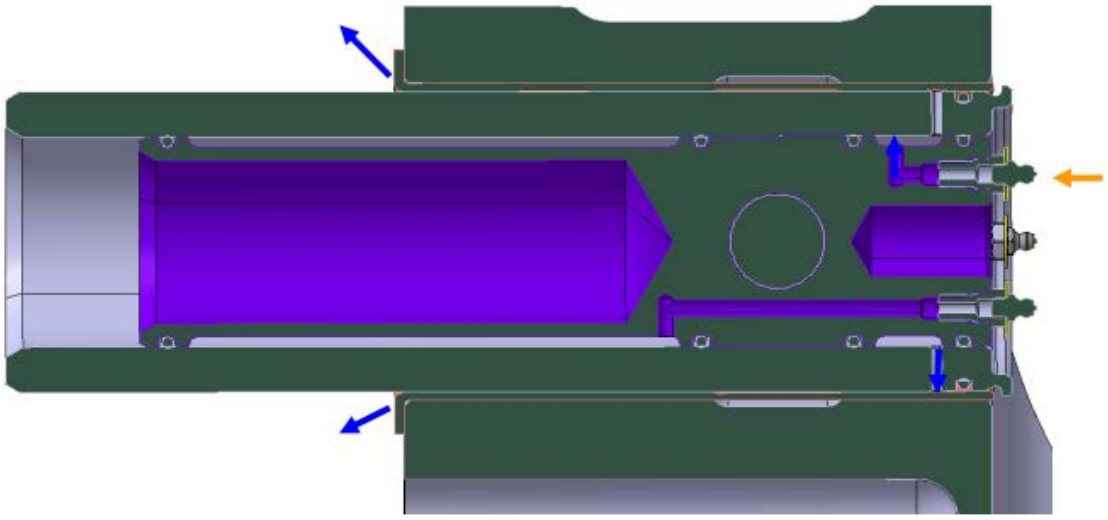
2.9	Upper torque link pin to cuff			45-46
3.0	Apex pin torque links			47-48
3.1	Lower torque link pin to MF			49-50

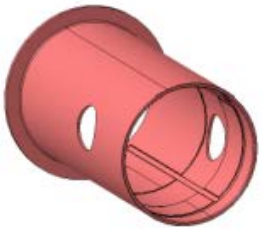


Ref. Number	1.1
Description	Pintle Pin LH (Static Joint Grease)
Method of greasing	Grease will be applied directly from outside by a greasing gun.
Grease entrance and witness	STATIC: Grease entering from the nipples will be applied for the cross bolt greasing to minimize corrosion and wear.
Grease distribution	Distribution is guaranteed by the lubrication chambers and correspondent cross holes.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun.
Comments	Additional sleeve (used for torque tightening) added below the nipples to avoid damages on the plastic (POM) grease insert during installation).



Ref. Number	1.1
Description	Pintle Pin LH (Dynamic Joint Grease/Pin to Airframe structure)
Method of greasing	Grease will be applied directly from outside by a greasing gun.
Grease entrance and witness	DYNAMIC: Grease entering from the nipples will flow over the contact are between the pin and the airframe interface.
Grease distribution	Distribution is guaranteed by the lubrication chambers and correspondent cross holes.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun.
Comments	Additional sleeve (used for torque tightening) added below the nipples to avoid damages on the plastic (POM) grease insert during installation).

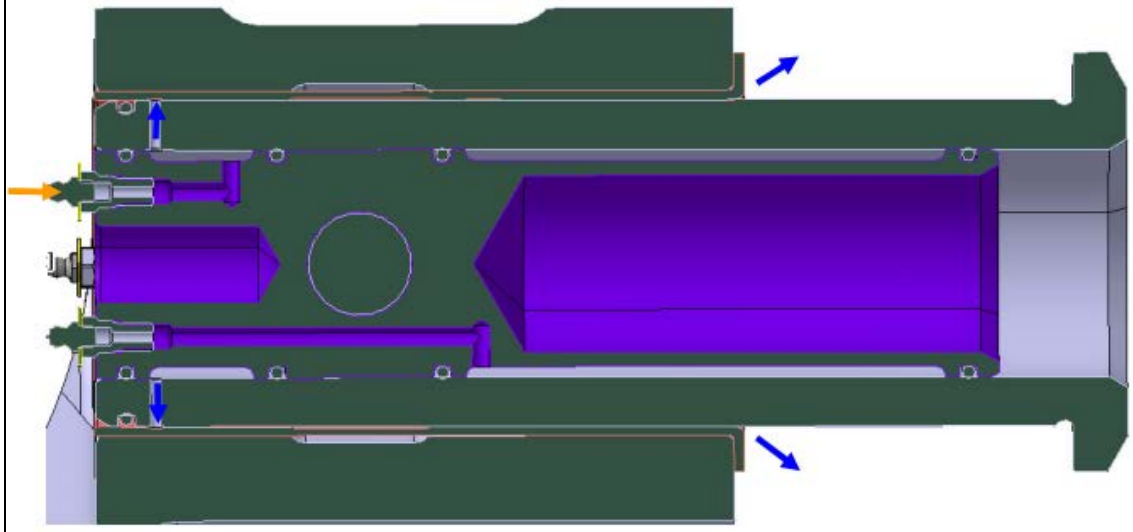


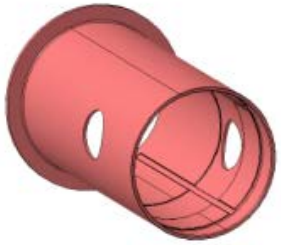


BUSH (AL-NI-BR 63020)

PIN (CUSTOM 465
HVOF PLATED)

Ref. Number	1.1
Description	Pintle Pin LH (Static Joint Grease/Pin to bushes)
Method of greasing	Grease will be applied directly from outside by a greasing gun.
Grease entrance and witness	STATIC: Grease entering from the nipples will be applied for the bearing and the bushes.
Grease distribution	Distribution is guaranteed by the lubrication chambers and grooves.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun.
Comments	Additional sleeve (used for torque tightening) added below the nipples to avoid damages on the plastic (POM) grease insert during installation).

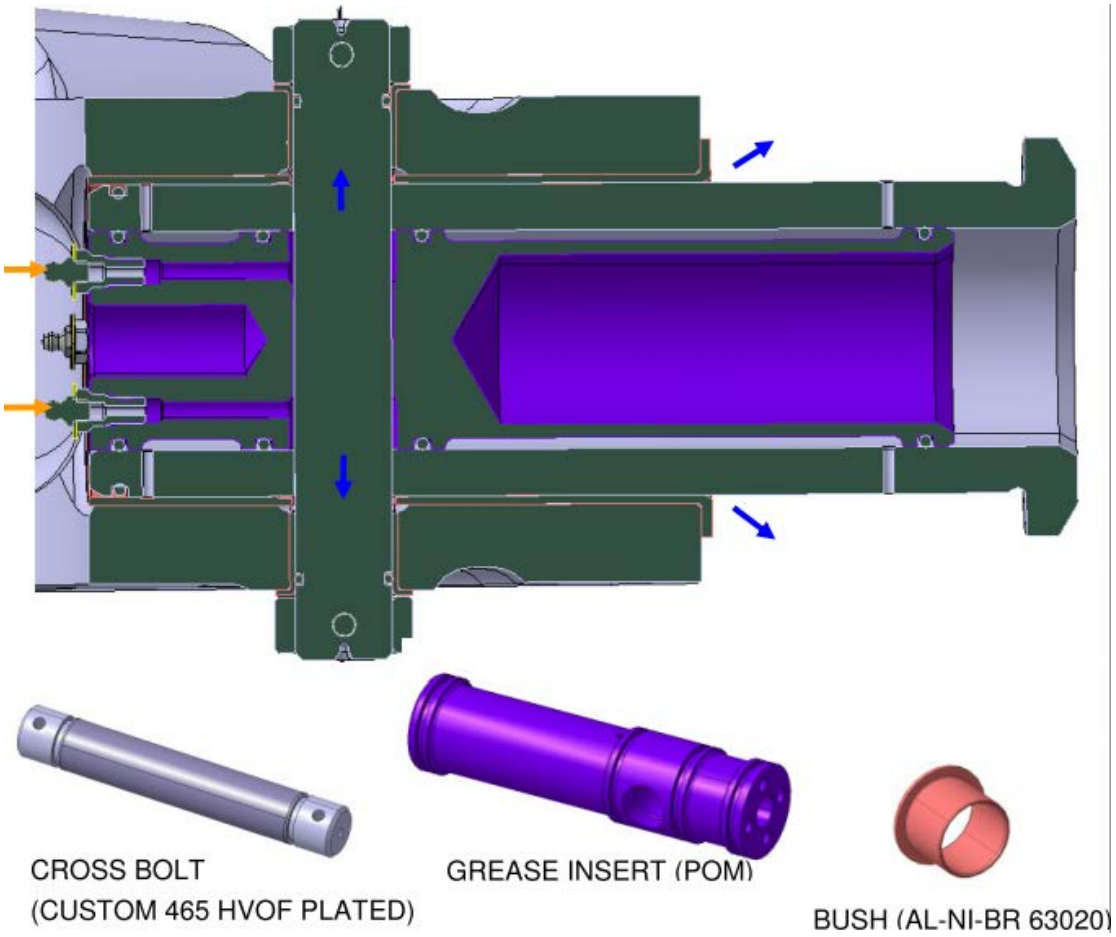




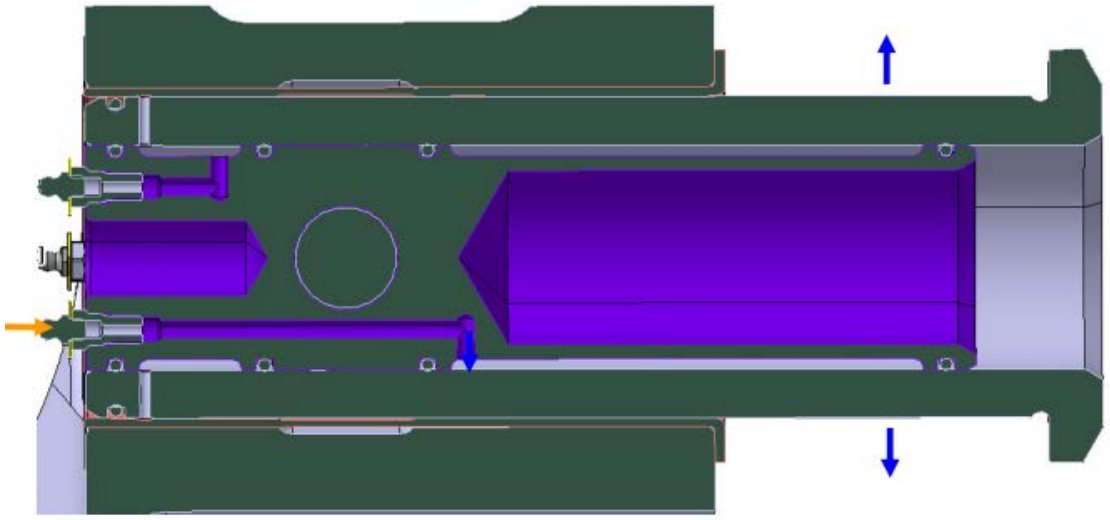
BUSH (AL-NI-BR 63020)

PIN (CUSTOM 465 HVOF PLATED)

Ref. Number	1.2
Description	Pintle Pin RH (Static Joint Grease/Pin to bushes)
Method of greasing	Grease will be applied directly from outside by a greasing gun.
Grease entrance and witness	STATIC: Grease entering from the nipples will be applied for the bearing and the bushes.
Grease distribution	Distribution is guaranteed by the lubrication chambers and correspondent cross holes.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun.
Comments	Additional Torque tightening sleeve added below the nipples to avoid damages on the plastic (POM) grease insert during installation.



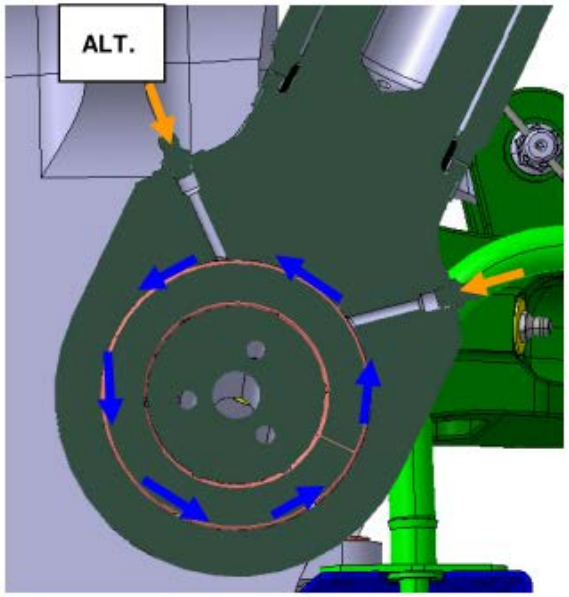
Ref. Number	1.2
Description	Pintle Pin RH (Static joint grease / Cross bolt)
Method of greasing	Grease will be applied directly from outside by a greasing gun.
Grease entrance and witness	STATIC: Grease entering from the nipples will be applied for the cross bolt greasing to minimize corrosion and wear.
Grease distribution	Distribution is guaranteed by the lubrication chambers and correspondent cross holes on the pi
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun.
Comments	Additional Torque tightening sleeve added below the nipples to avoid damages on the plastic (POM) greas insert during installation.

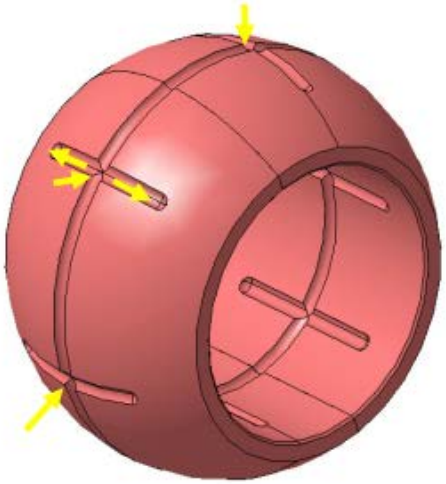


PIN (CUSTOM 465 HVOF PLATED)

GREASE INSERT (POM)

Ref. Number	1.2
Description	Pintle Pin RH (Dynamic Joint Grease/Pin to Airframe)
Method of greasing	Grease will be applied directly from outside by a greasing gun.
Grease entrance and witness	DYNAMIC: Grease entering from the nipples will flow over the contact are between the pin and the airframe interface.
Grease distribution	Distribution is guaranteed by the lubrication chambers and correspondent cross holes on the pi
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun.
Comments	Additional Torque tightening sleeve added below the nipples to avoid damages on the plastic (POM) greas insert during installation.





SPLIT BALL (TOUGHMET 3)

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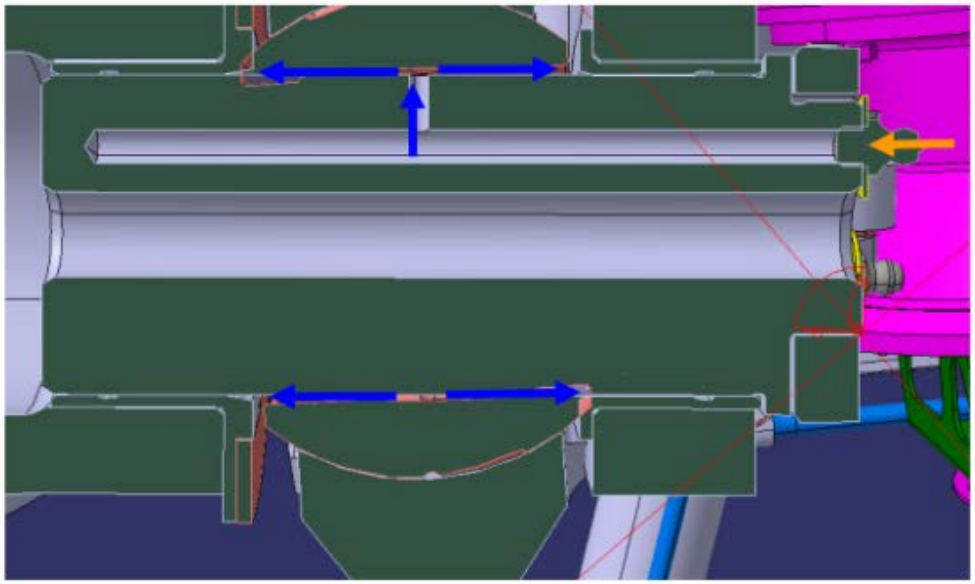
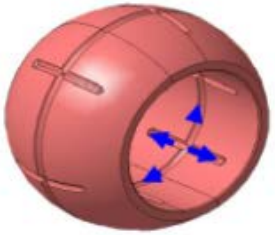
Nickel / Bronze

Ref. Number	1.3
Description	Retraction Actuator rod end (Spherical bearing)
Method of greasing	Grease will be applied directly from outside (one side only) by a greasing gun.
Grease entrance and witness	Picture shows how the grease will Enter from the grrease fitting to the Spherical bearing.
Grease distribution	Grease will be equally distributed All over the ball and to the interface Pin by distribution grooves.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun in NLG extended position.
Comments	Alt. Grease nipple used for fool proof installation.

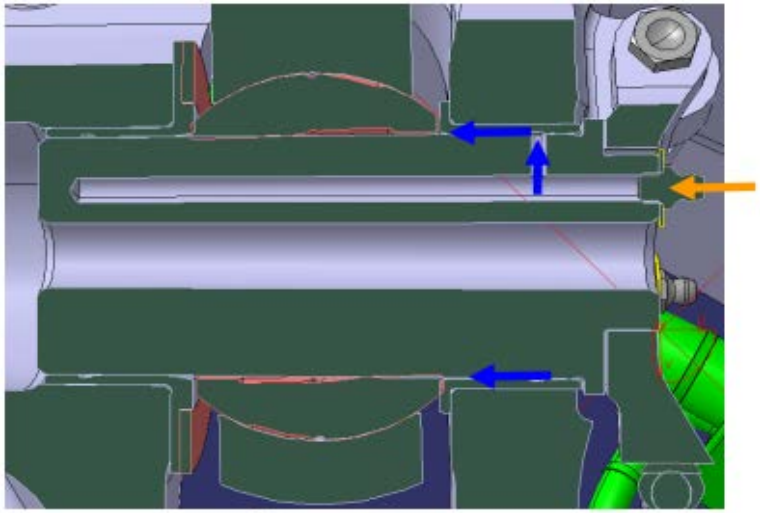


PIN (15-5PH HVOF PLATED)

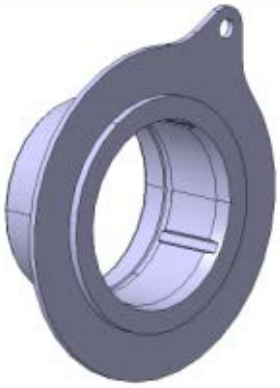


SPLIT BALL (TOUGHMET 3)

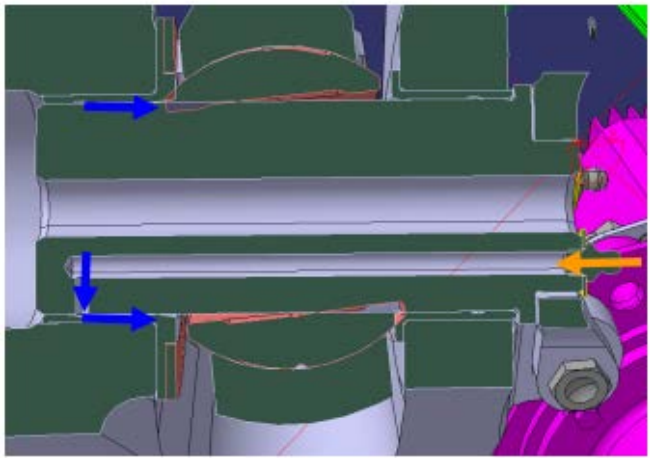
Ref. Number	1.4
Description	Retraction Actuator rod end (Dynamic joint grease/pin to spherical bearing)
Method of greasing	Grease will be applied directly from outside (one side only) by a greasing gun.
Grease entrance and witness	Grease will be applied from the nipples; witness is guaranteed through the ball grooves.
Grease distribution	Grease will be equally distributed all inside the ball and pin surface.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun in NLG extended position.
Comments	.



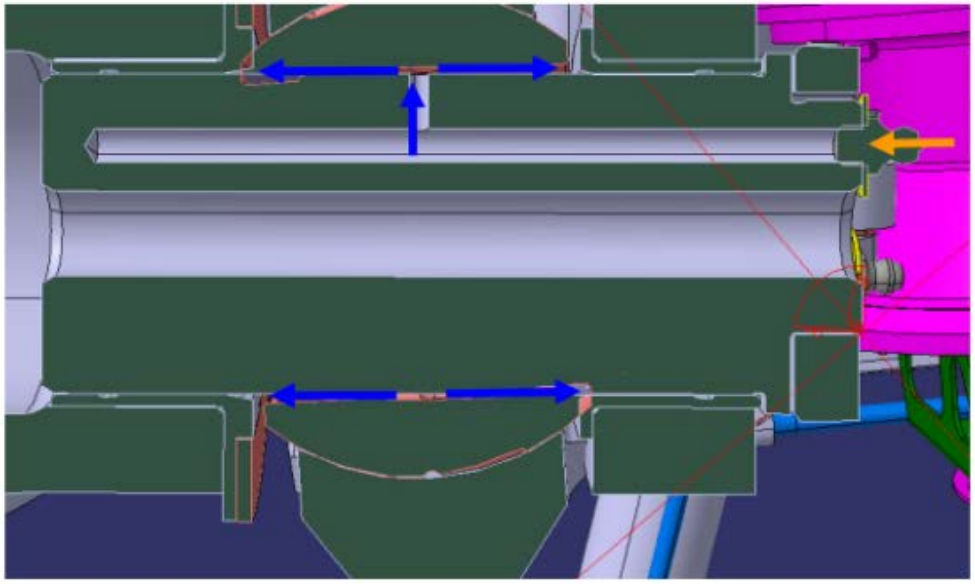
BUSH (17-4PH)



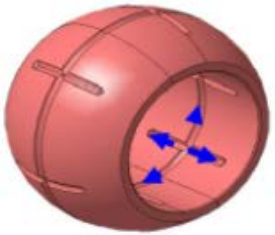
BUSH (15-5PH)



Ref. Number	1.4
Description	Retraction Actuator rod end (Static j bushes)
Method of greasing	Grease will be applied directly from outside (one side only) by a greasing gun.
Grease entrance and witness	Grease will be applied from 2 Separate nipples; witness is Guaranteed through the grooves on the bushes.
Grease distribution	Grease will be equally distributed all over the bushes by distribution grooves.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun in NLG extended position.
Comments	.

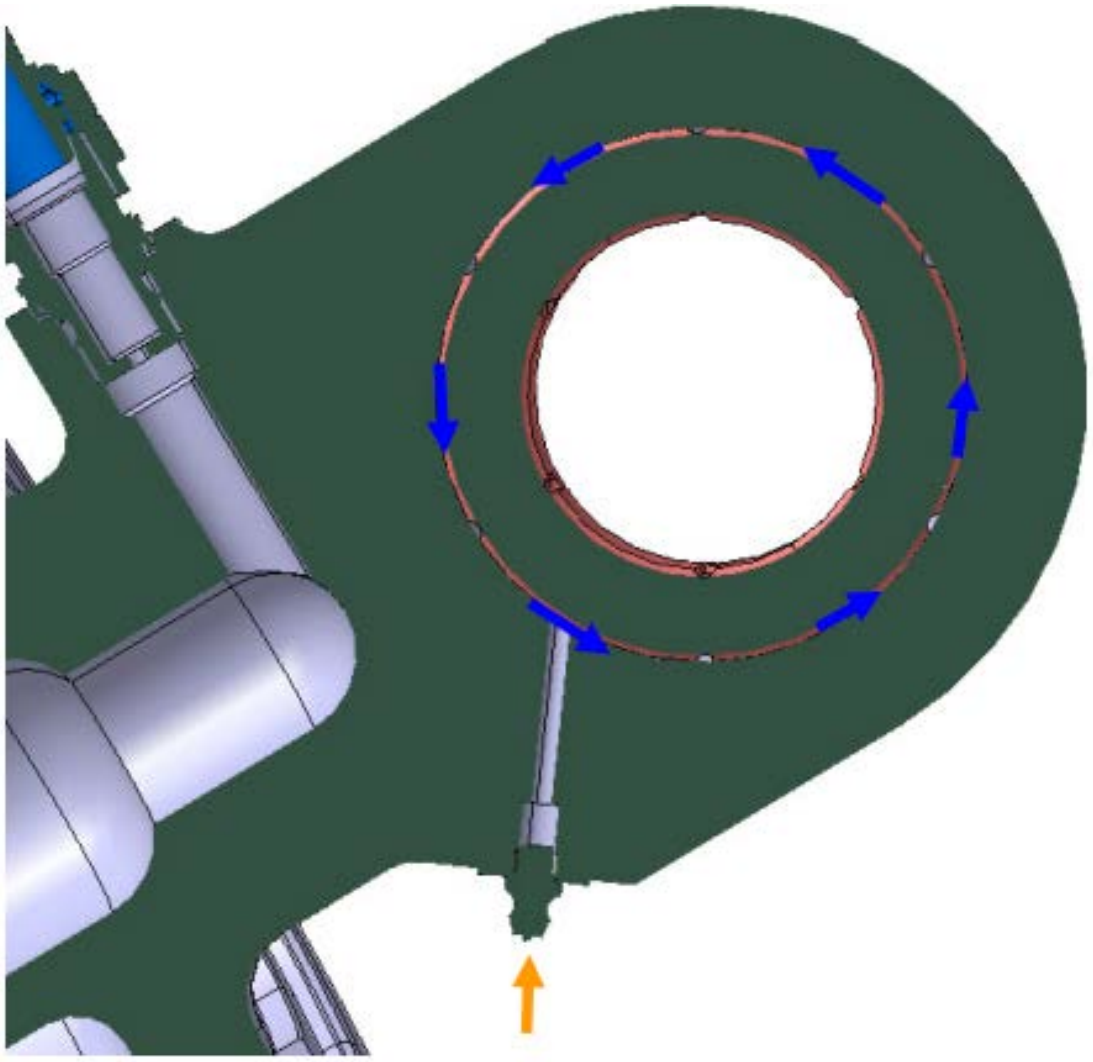


PIN (15-5PH HVOF PLATED)

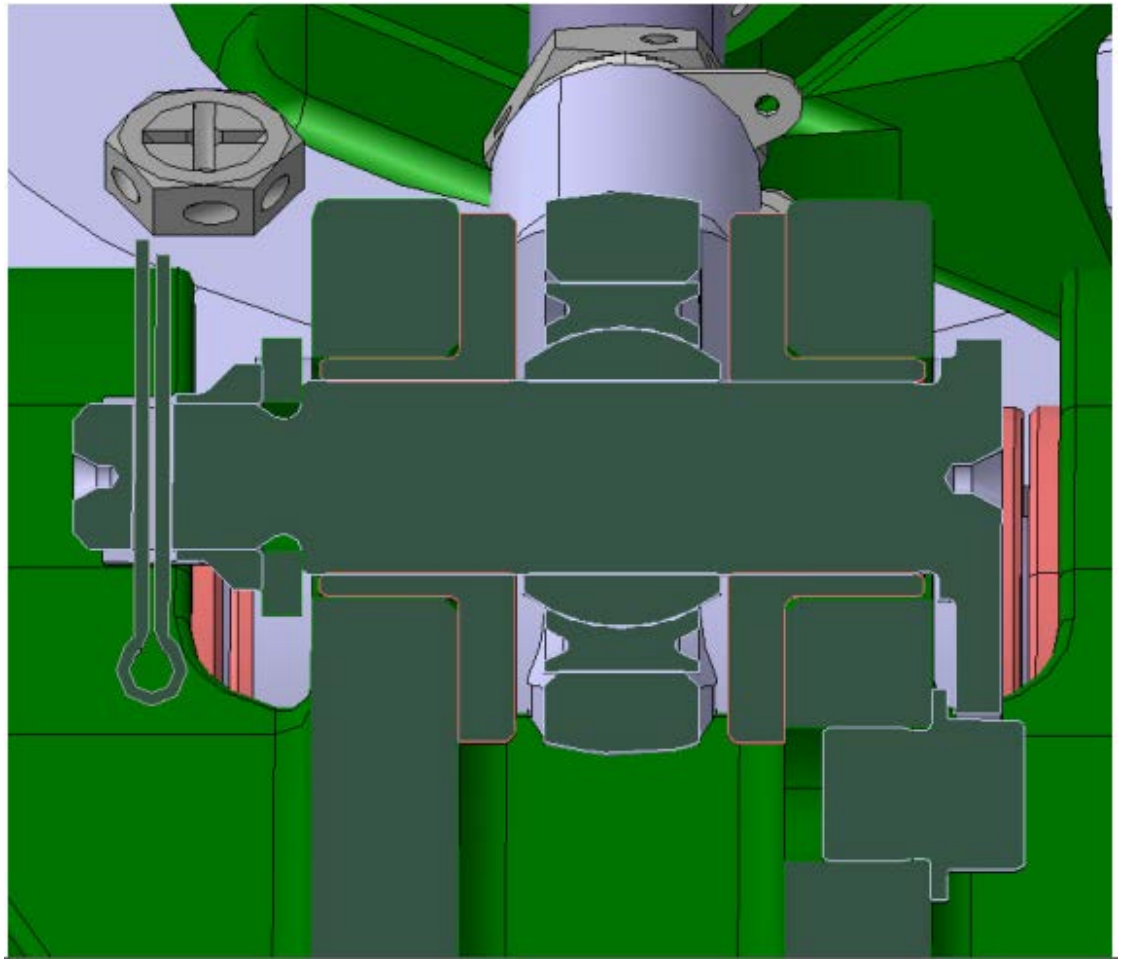


SPLIT BALL (TOUGHMET 3)

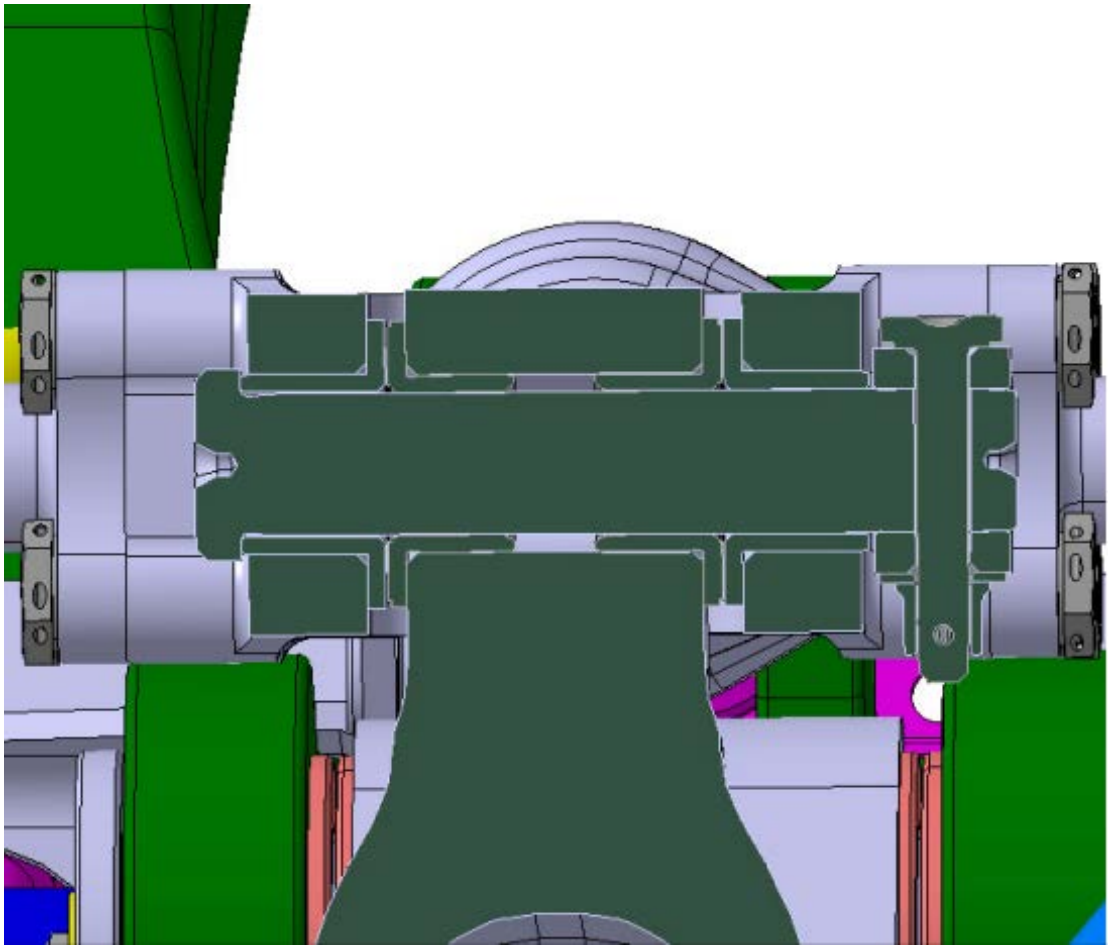
Ref. Number	1.4
Description	Retraction Actuator rod end (Dynamic joint grease/pin to spherical bearing)
Method of greasing	Grease will be applied directly from outside (one side only) by a greasing gun.
Grease entrance and witness	Grease will be applied from the nipples; witness is guaranteed through the ball grooves.
Grease distribution	Grease will be equally distributed all inside the ball and pin surface.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun in NLG extended position.
Comments	.



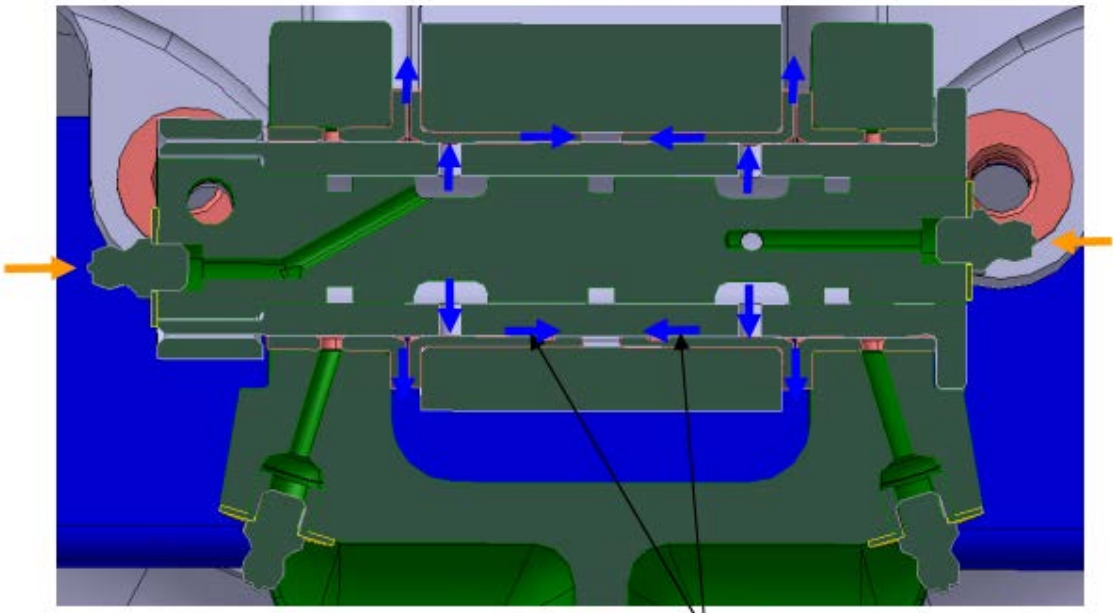
Ref. Number	1.5
Description	Retraction Actuator head end
Method of greasing	Grease will be applied directly from Outside through the grease nipple (one side only) by a greasing gun.
Grease entrance and witness	Picture shows how the grease will enter from the grease fitting to the link body.
Grease distribution	Grease will be equally distributed all over the ball and to the interface pin by distribution grooves.
Accessibility	Accessibilty is guaranteed from outside by using a standart grease gun in NLG extended position.
Comments	.



Ref. Number	1.6
Description	Unlock Actuator rod end
Method of greasing	N/A
Grease entrance and witness	N/A
Grease distribution	N/A
Accessibility	N/A
Comments	A self lubricated bearing is used for this application; no needs of greasing insert or nipples due to static application.



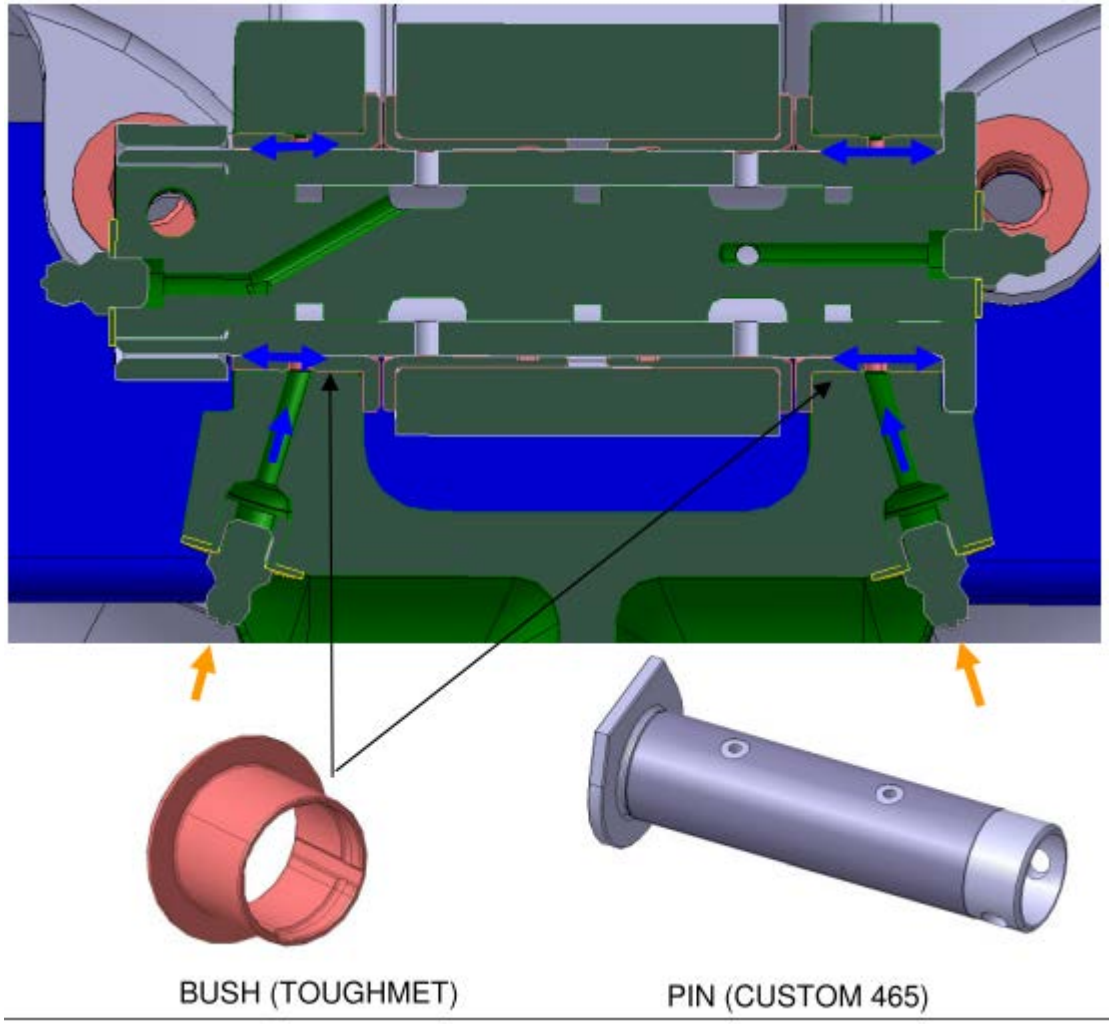
Ref. Number	1.7
Description	Unlock Actuator head end (Housing)
Method of greasing	N/A
Grease entrance and witness	N/A
Grease distribution	N/A
Accessibility	N/A
Comments	Self lubricated bushes are used for this application; no needs of greasing due to static application.



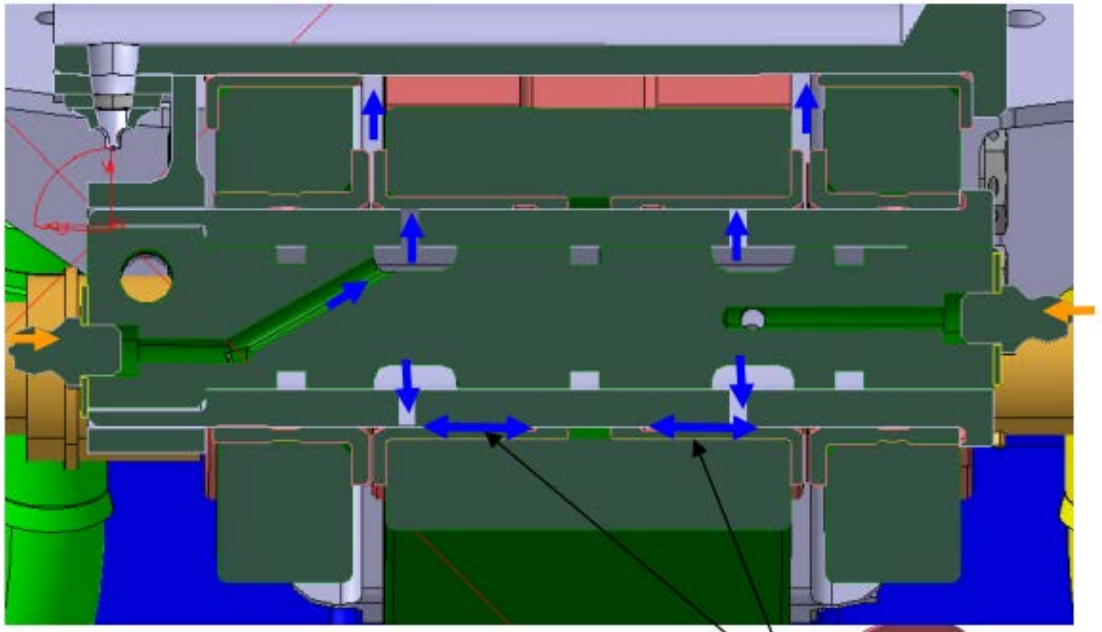
GREASE INSERT (ALUMINUM)

BUSH (AL-NI-BR 63020)

Ref. Number	1.8
Description	Upper locking stay to main fitting (Dynamic Joint grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using grease gun.
Grease entrance and witness	Grese will enter from the grease nipples; witness is guaranteed by the grooves on the bushes (as shown).
Grease distribution	Distribution is guaranteed by the grooves on the greasing pin, cross holes on the pin and grooves on the bushes.
Accessibility	N/A
Comments	



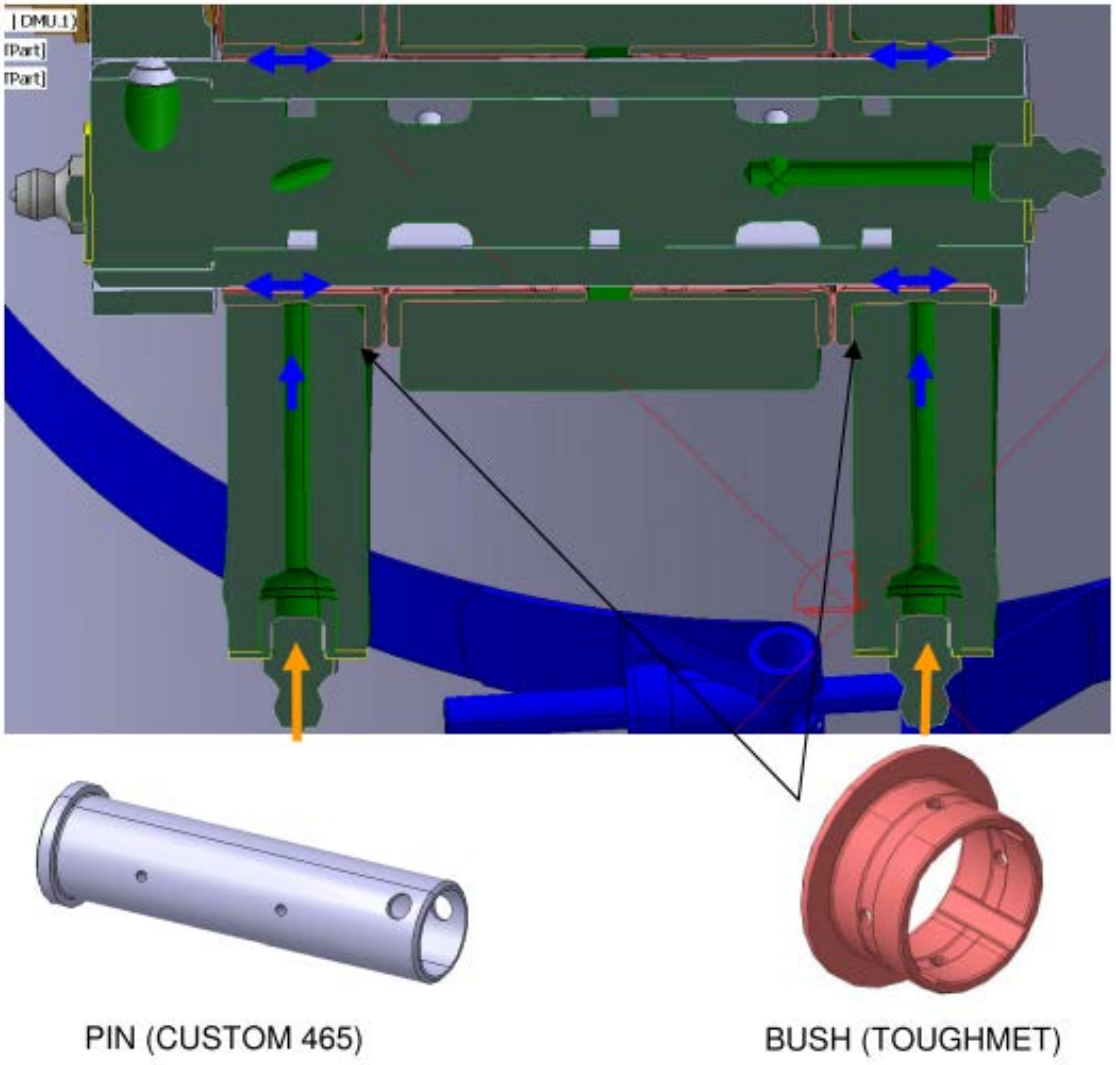
Ref. Number	1.8
Description	Upper locking stay to main fitting (Static Joint grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using grease gun.
Grease entrance and witness	Grease will enter from the grease nipples; witness is guaranteed by the grooves on the bushes (as shown).
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	



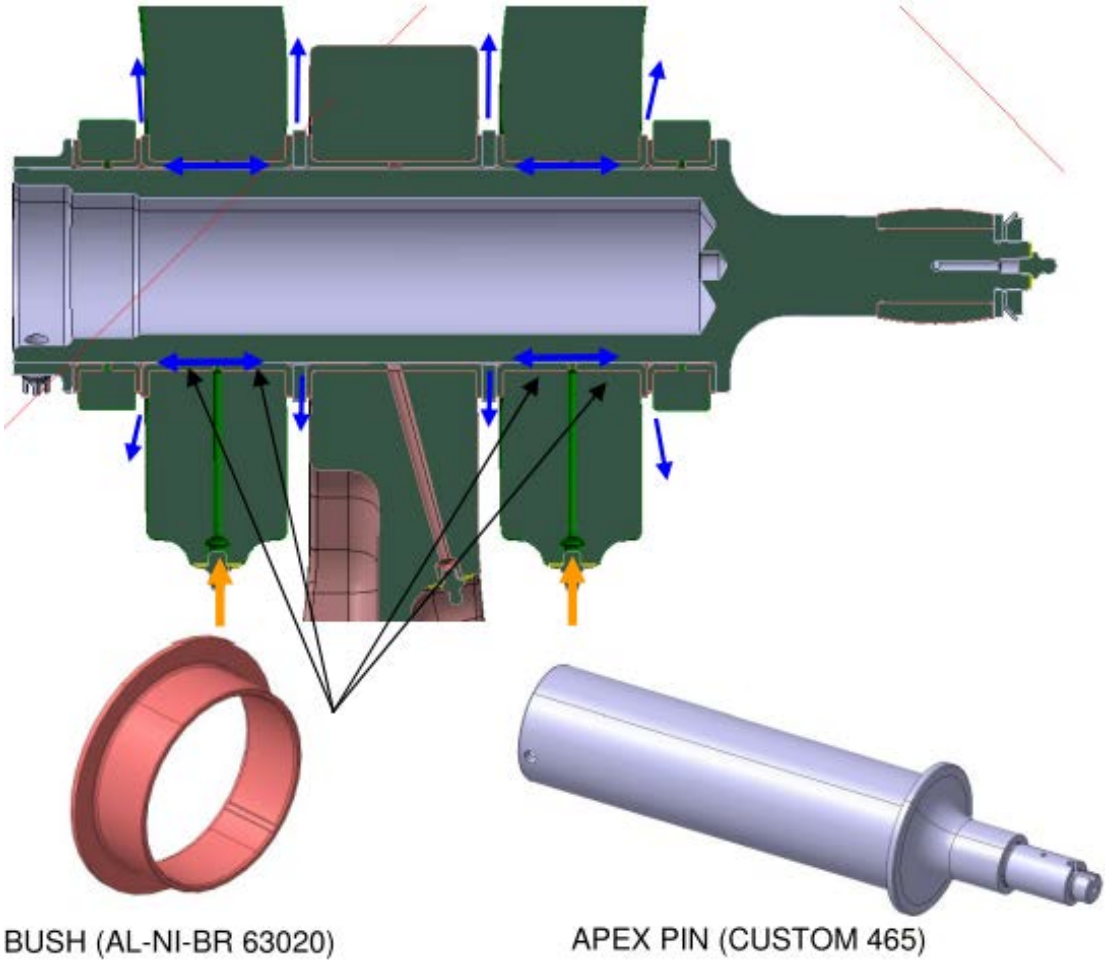
GREASE INSERT (ALUMINUM)

BUSH (AL-NI-BR 63020)

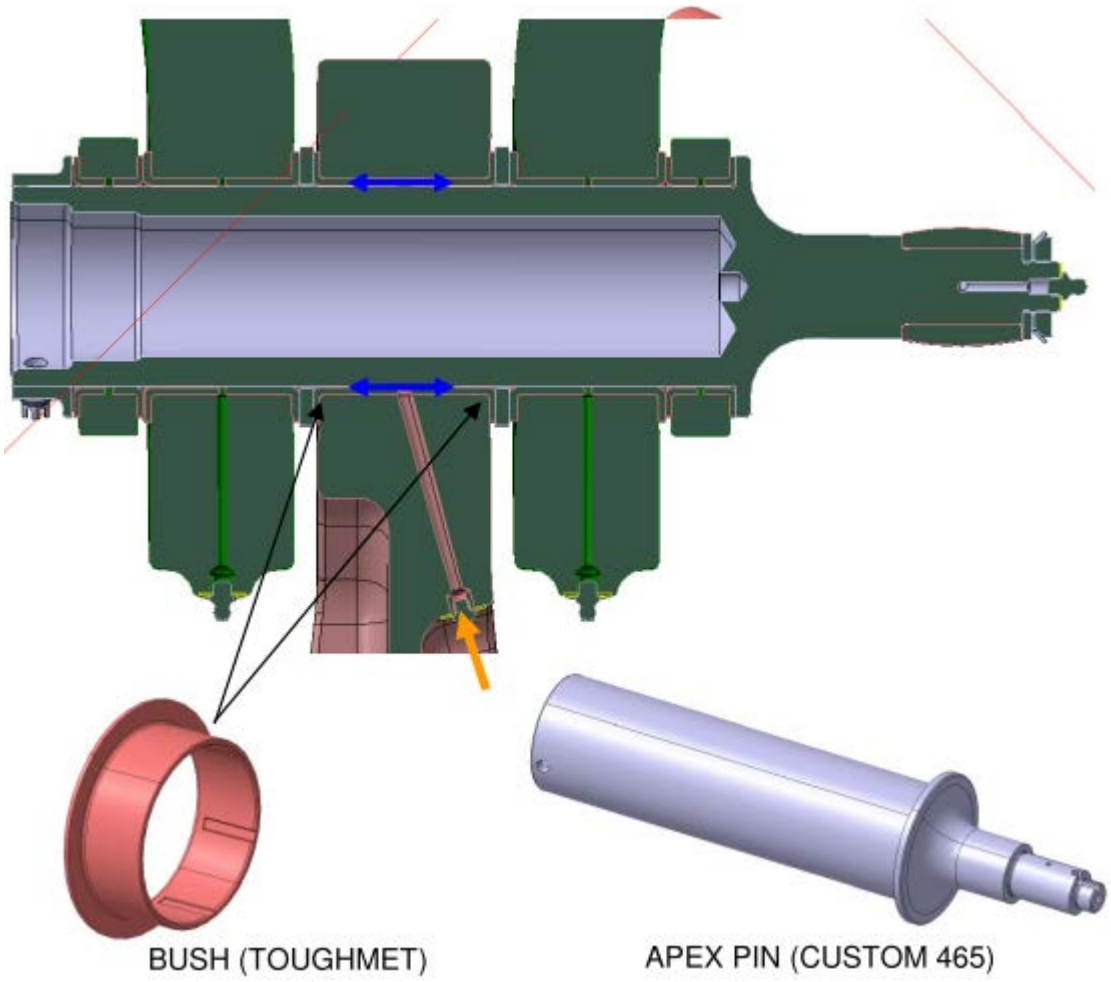
Ref. Number	1.9
Description	Apex pin lower to upper locking stay (Dynamic Joint Grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the greasing pin, cross holes on the pin and grooves on the bushes.
Accessibility	N/A
Comments	



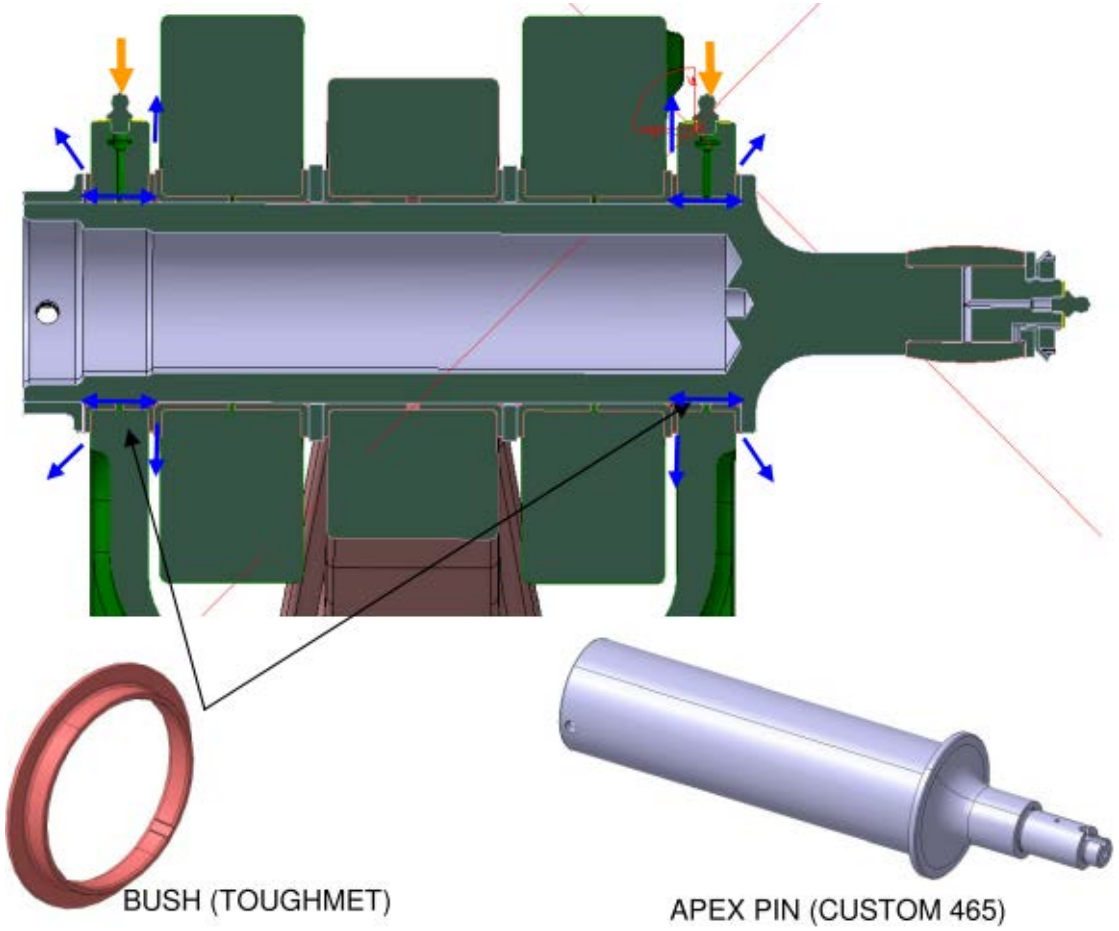
Ref. Number	1.9
Description	Apex pin lower to upper locking stay (Static Joint Grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	



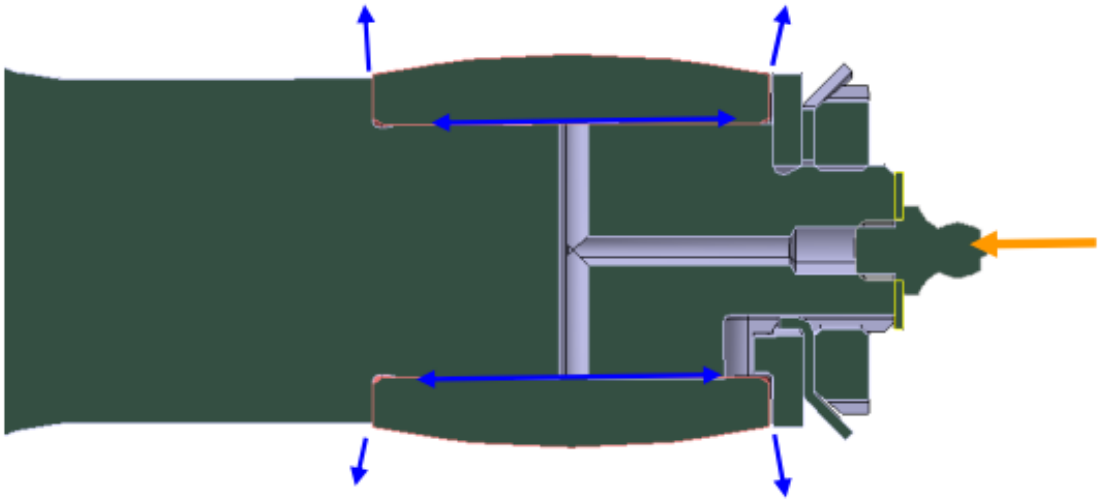
Ref. Number	2.0
Description	Apex pin (Dynamic Joint Grease / Upper drag stay to apex pin)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	

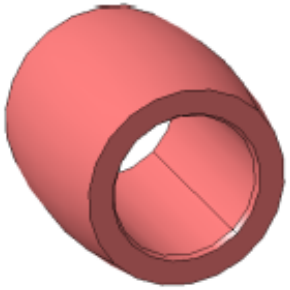


Ref. Number	2.0
Description	Apex pin (Lower drag stay to apex pin)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	



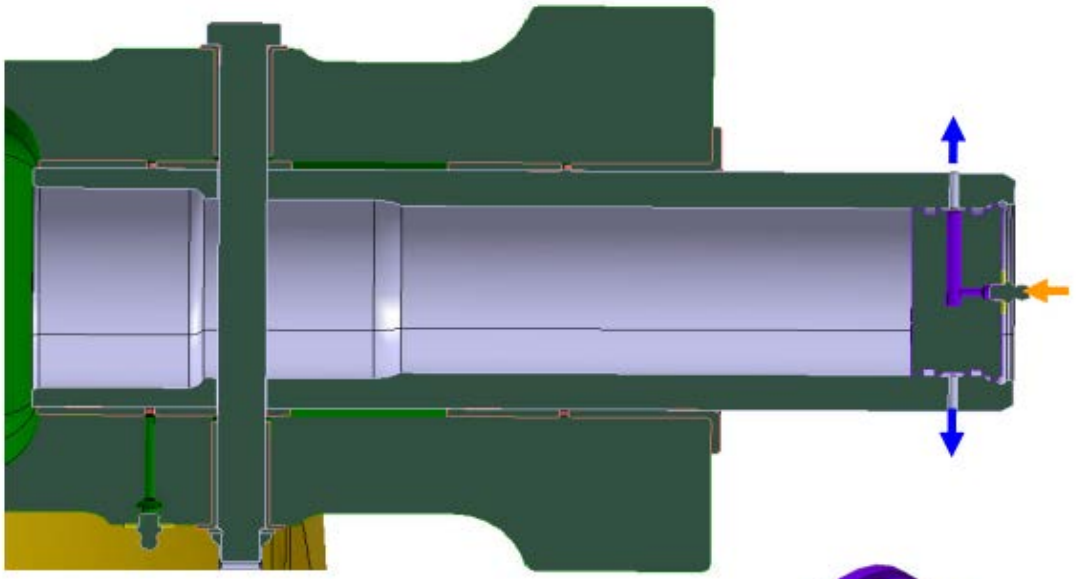
Ref. Number	2.0
Description	Apex pin (Lower lock link to apex pin)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	



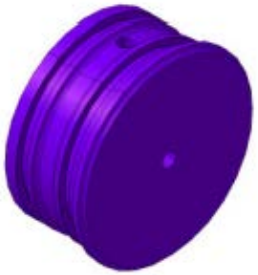


BUSH (TOUGHMET)

Ref. Number	2.0
Description	Apex pin (Up lock roller bearing)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the roller bearing.
Grease distribution	Distribution is guaranteed by the grooves on the roller bearing.
Accessibility	N/A
Comments	

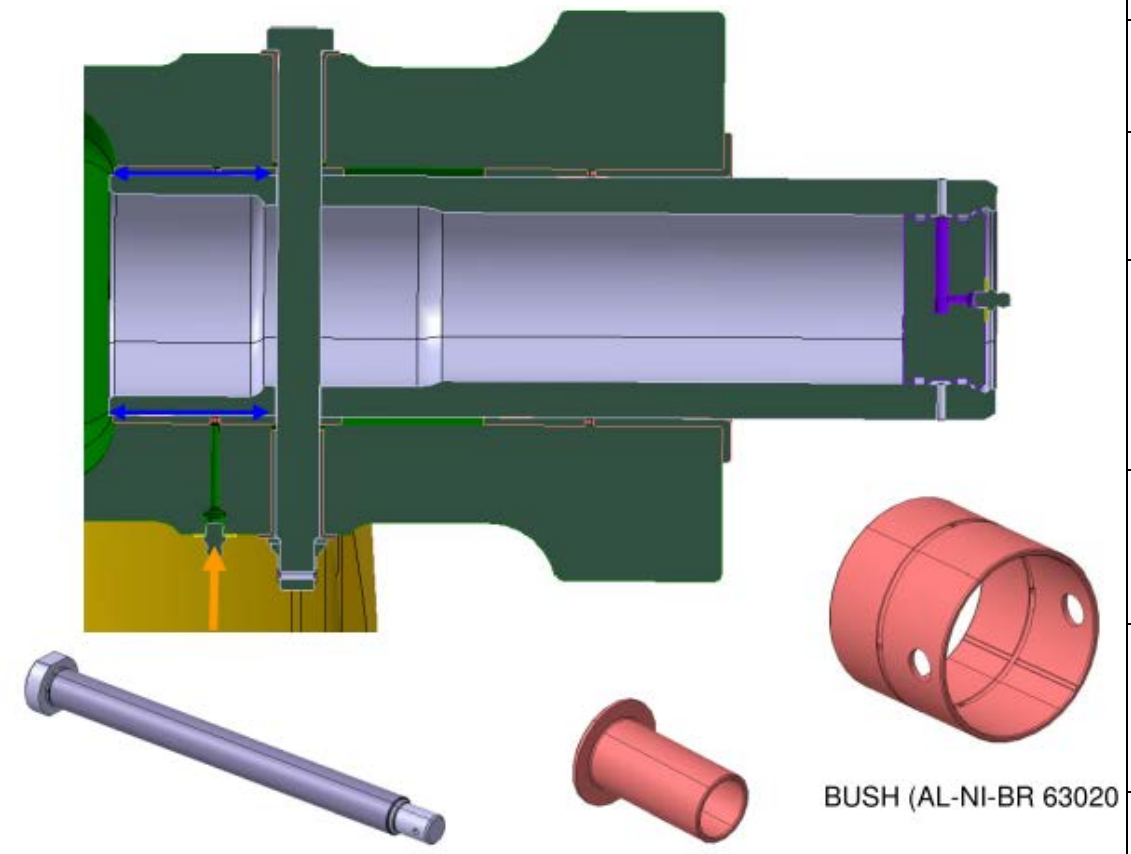


PINTLE PIN (CUSTOM 465 HVOF PLATED)

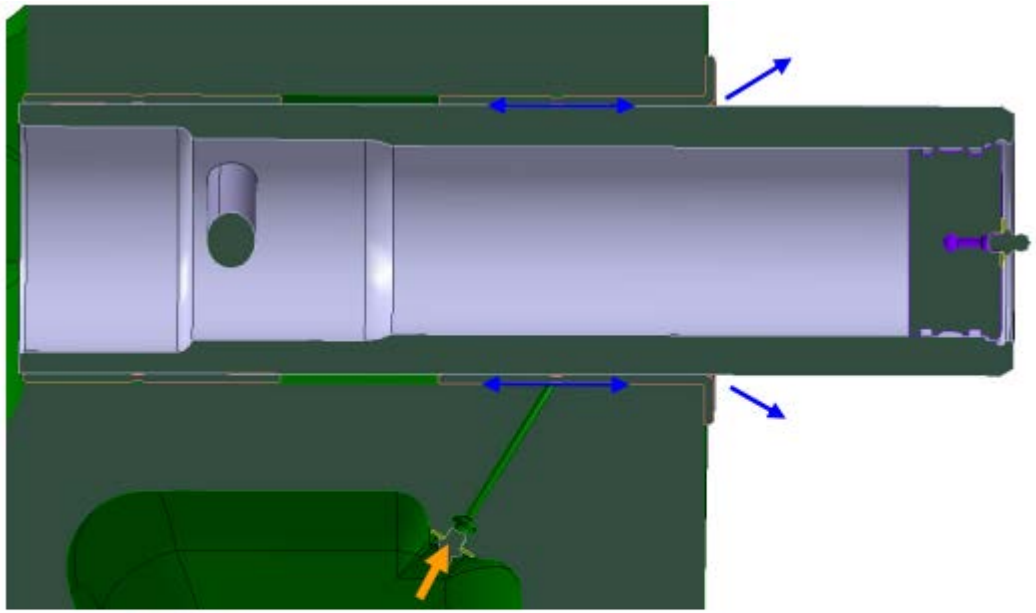


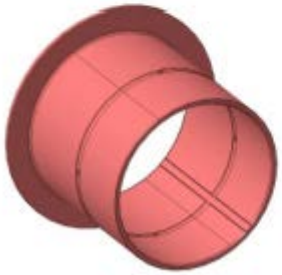
GREASE INSERT (PA 6.6)

Ref. Number	2.1
Description	Upper drag stay Pintle pin LH & RH (Dynamic Joint Grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a greasing gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the interface mounting on the airframe.
Grease distribution	N/A
Accessibility	N/A
Comments	Typical LH and RH Additional torque tightening sleeve is added below the nipples to avoid damages on the plastic grease insert during installation.



Ref. Number	2.1
Description	Upper drag stay pintle pin (Static Joint Grease – Cross bolt and pin to bush)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	STATIC: Grease entering from the nipples are applied for the cross bolt to minimize corrosion and wear and to the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	Typical LH and RH

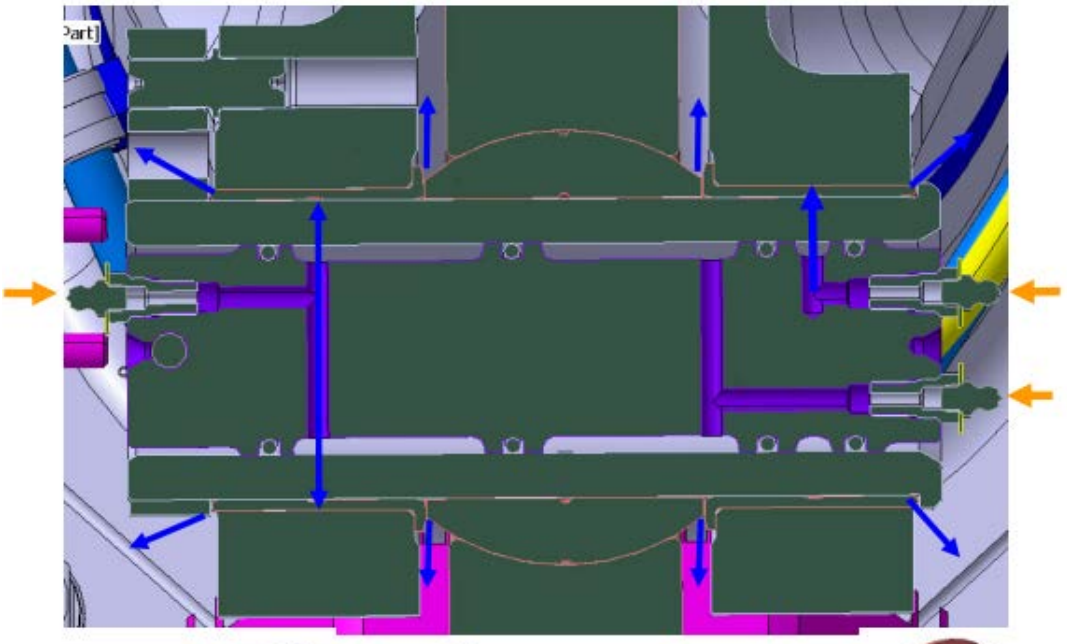




BUSH (AL-NI-BR 63020)

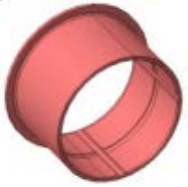
PINTLE PIN (CUSTOM 465 HVOF PLATED)

Ref. Number	2.1
Description	Upper drag stay pintle pin (Static Joint Grease – Pin to bush)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from the nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bush.
Accessibility	N/A
Comments	Typical LH and RH



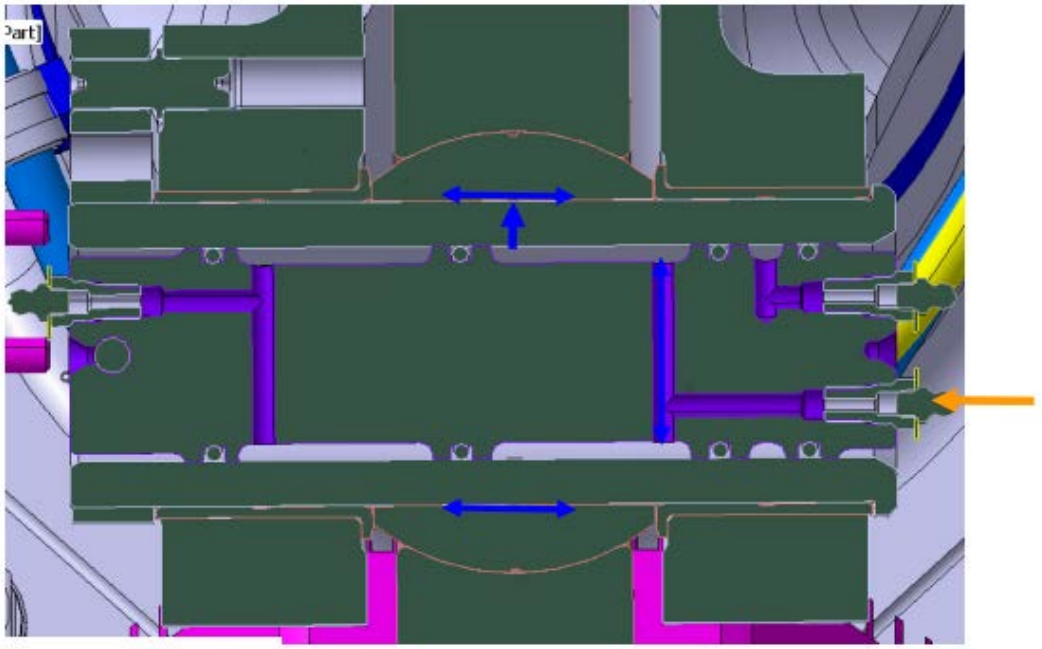
PIN (CUSTOM 465)

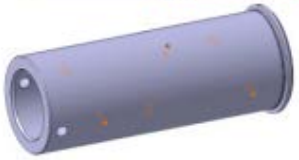
GREASE INSERT (POM)



BUSH (AL-NI-BR 63020)

Ref. Number	2.2
Description	Lower drag stay pin (Static Joint Grease / Pin to bushes)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from the nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the greasing pin, cross holes on the pin and grooves on the bushes.
Accessibility	N/A
Comments	Additional Torque tightening sleeve added below the nipples to avoid damages on the plastic (POM) grease insert during installation.



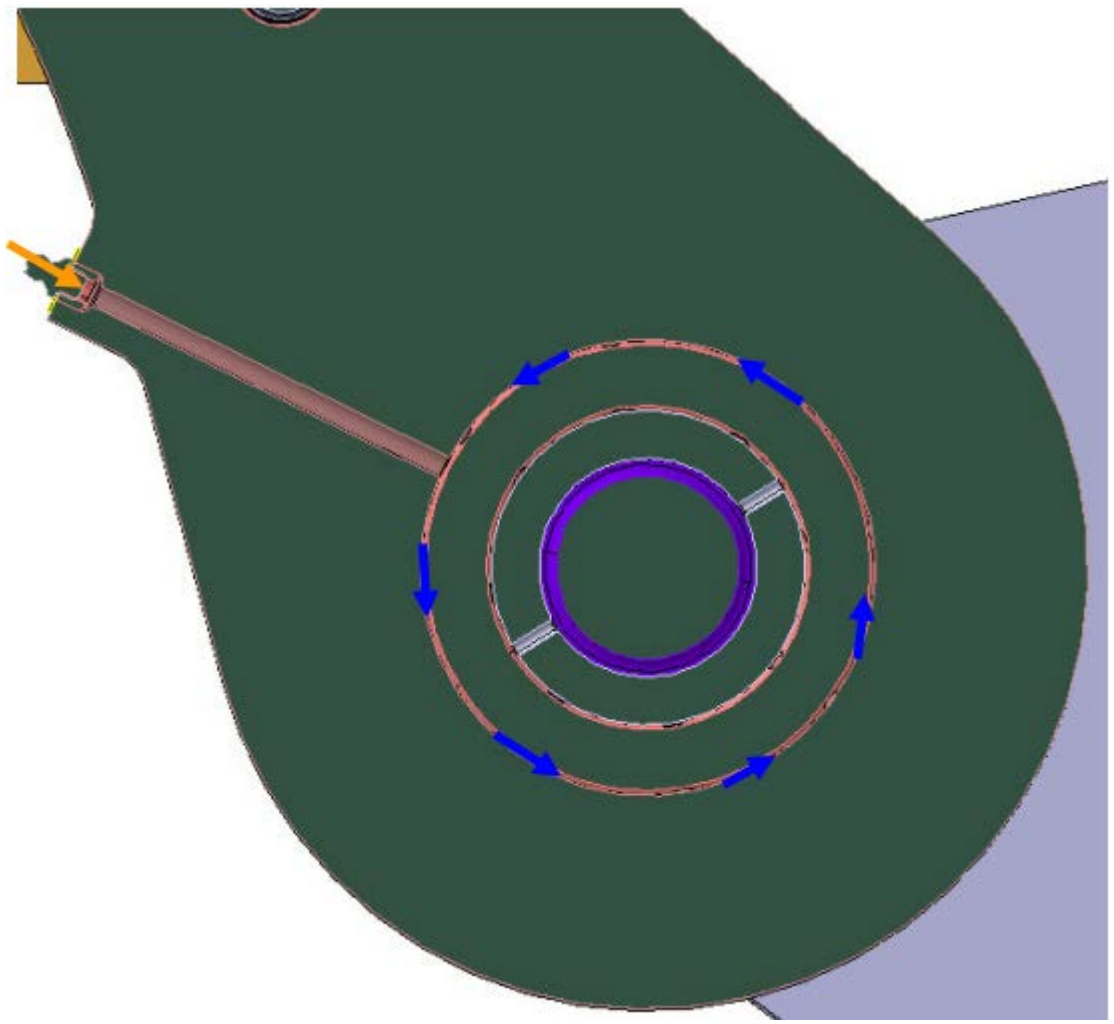


PIN (CUSTOM 465)

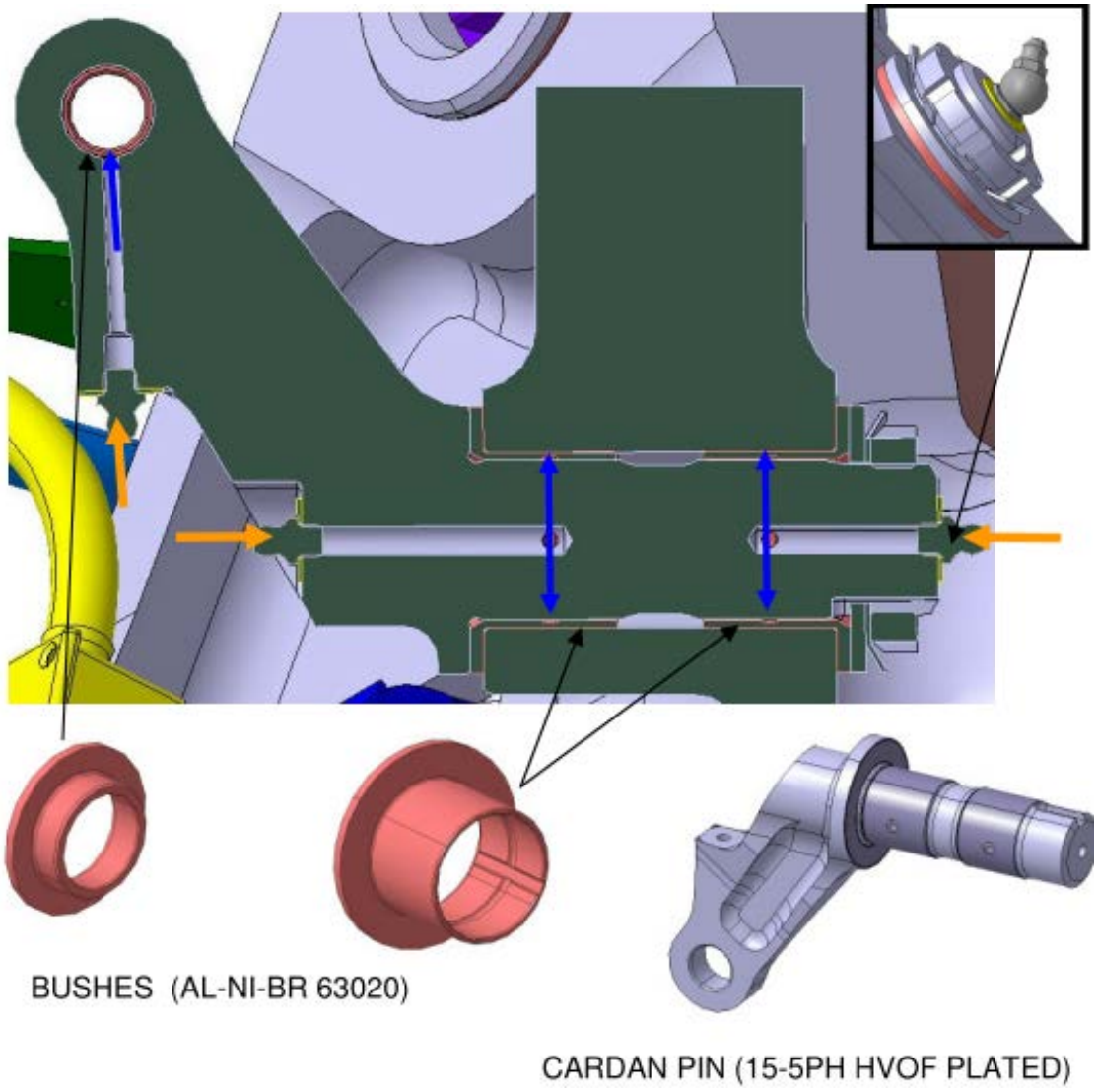
GREASE INSERT (POM)

SPLIT BALL (TOUGHMET 3)

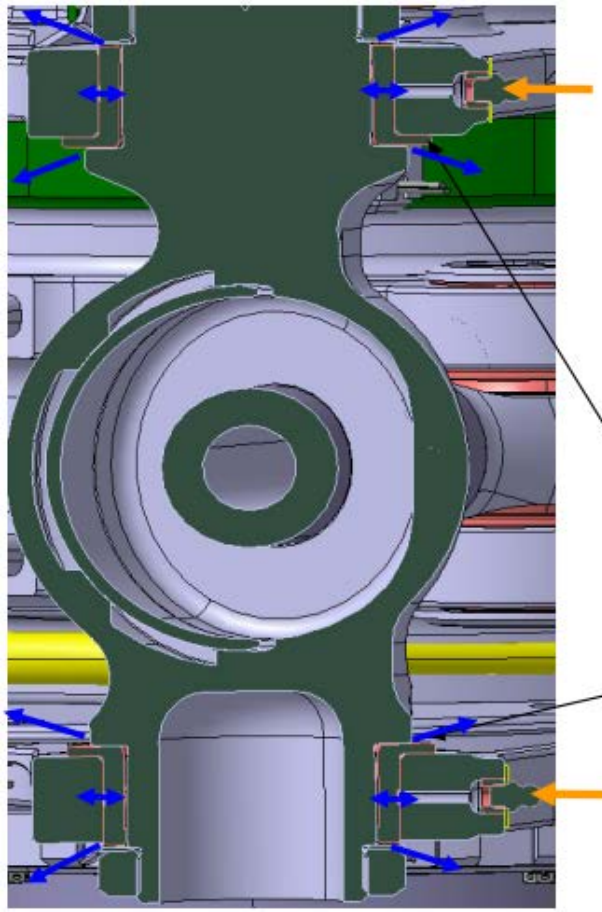
Ref. Number	2.2
Description	Lower drag stay pin (Dynamic Joint Grease – Pin to spherical bearing)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from the nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Grease will be equally distributed all inside the ball and pin surface.
Accessibility	N/A
Comments	Additional Torque tightening sleeve added below the nipples to avoid damages on the plastic (POM) grease insert during installation.

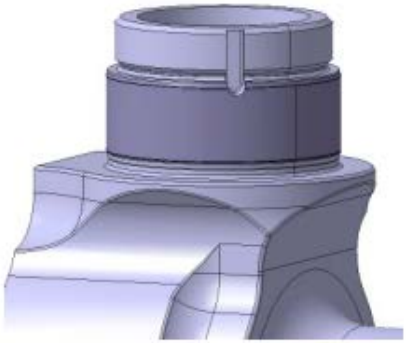


Ref. Number	2.3
Description	Lower drag stay ball bearing (Dynamic Joint Grease – Split Ball bearing – Lower Drag Stay)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from the nipple, is applied on the outer ball surface.
Grease distribution	Distribution is guaranteed by the grooves on the ball bearing.
Accessibility	N/A
Comments	



Ref. Number	2.4
Description	Cardan Pin
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes, the gap between the small bushes and the cross holes on the pin.
Accessibility	N/A
Comments	45º grease nipple is used on this installation to guarantee the access from outside (nipple orientation will be checked on first installation and eventually replaced with a standart straight grease nipple).

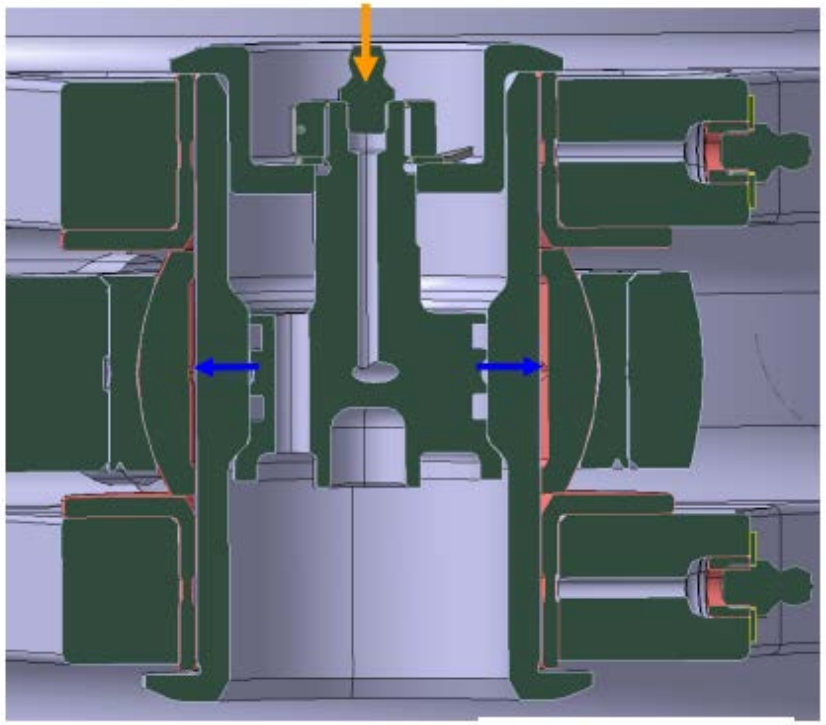


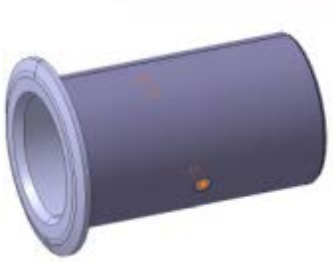


TRUNNION (15-5PH HVOF PLATED)

BUSH (AL-NI-BR 63020)

Ref. Number	2.5
Description	Upper and lower steering plate (Dynamic Joint grease – Steering Actuator attachment)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes.
Accessibility	N/A
Comments	Typical LH and RH side.

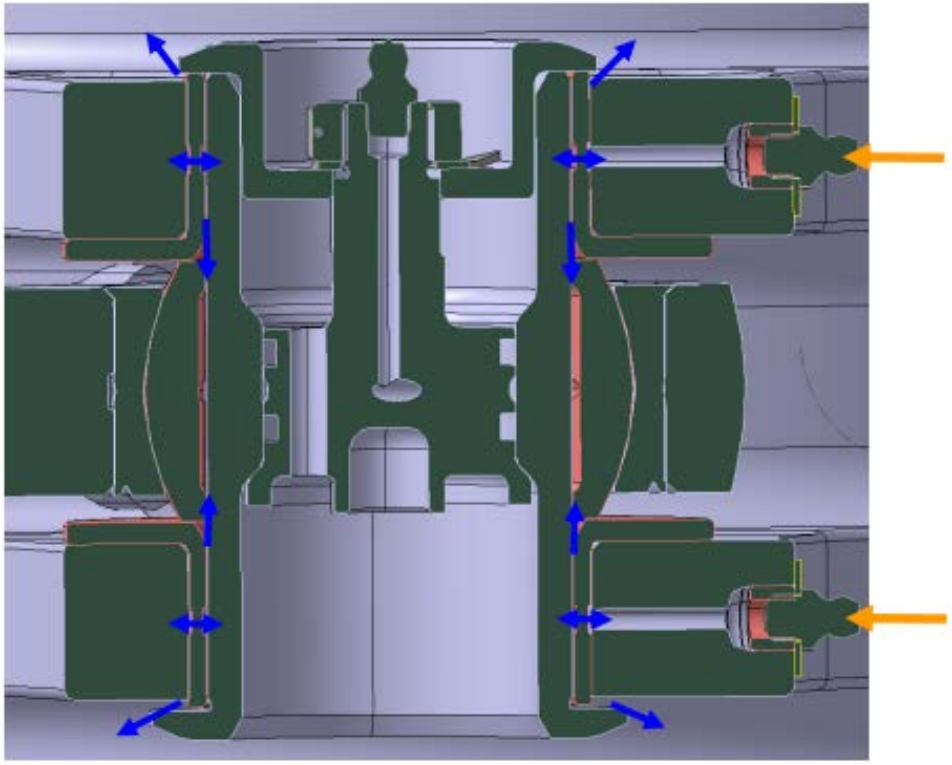




PIN (15-5 PH HVOF PLATED)

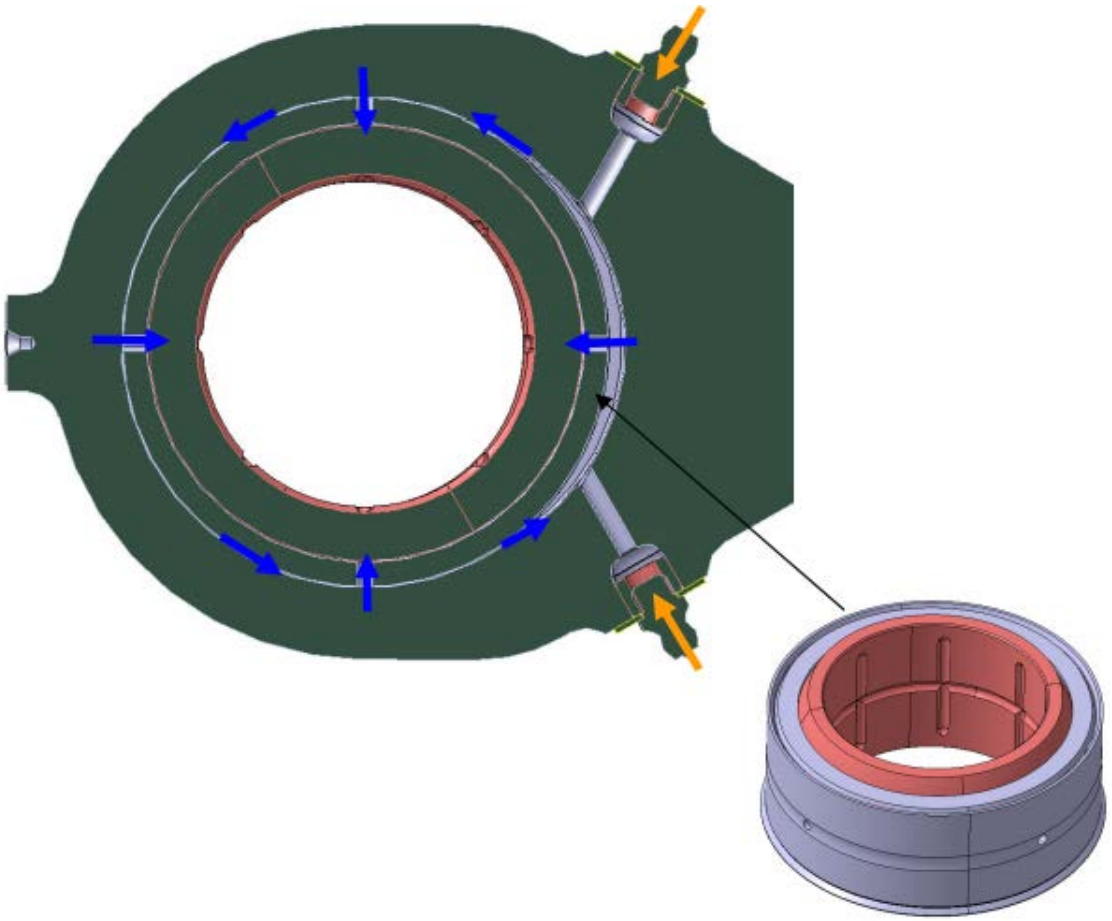
GREASE INSERT (1.4544)

Ref. Number	2.6
Description	Steering Actuator Pin (Dynamic Joint Grease – Pin to Split ball bearing)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the cross holes on the pin.
Grease distribution	Distribution is guaranteed by the grooves on the contact area between pin and swaged bearing.
Accessibility	N/A
Comments	Typical LH and RH side, accessibility to the nipple on the top will be tested during first installation: Use of different grease coupling could be an option.



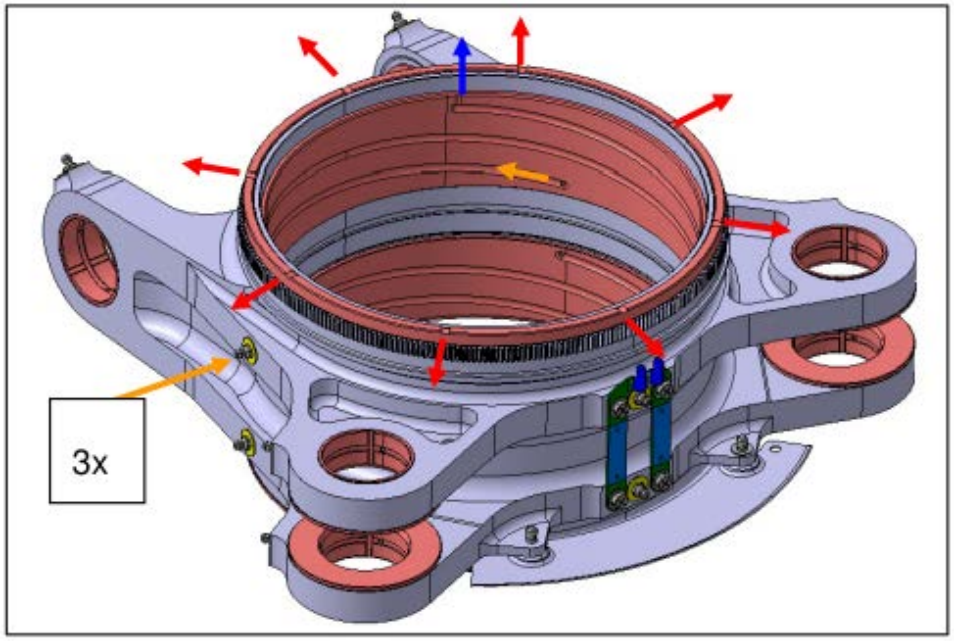
BUSH (AL-NI-BR 63020)

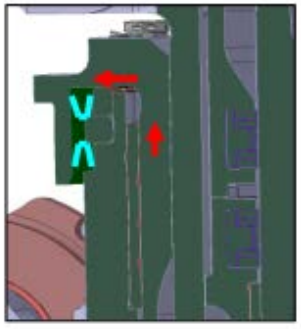
Ref. Number	2.6
Description	Steering Actuator Pin (Dynamic Joint Grease – Steering Pin to cuff bushes)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves on the bushes.
Grease distribution	Distribution is guaranteed by the grooves on the bushes, grease will be also applied on the contact area between bushes and swaged bearin
Accessibility	N/A
Comments	Typical LH and RH side, accessibility to the nipple on the top will be tested during first installation: Use of different grease coupling could be an option.



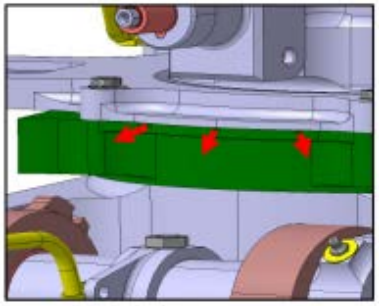
SWAGED BEARING (SPLIT BALL TYPE TOUGHMET 3)

Ref. Number	2.7
Description	Swaged bearing steering actuator (Dynamic joint grease – Swaged spherical bearing / piston rod)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples, witness is guaranteed by the grooves and cross holes on the spherical bearing.
Grease distribution	Distribution is guaranteed by the cross holes on the swaging collar and grooves on the spherical bearing.
Accessibility	N/A
Comments	Typical LH and RH side, nipples can be used alternatively depending by the accessibilty.



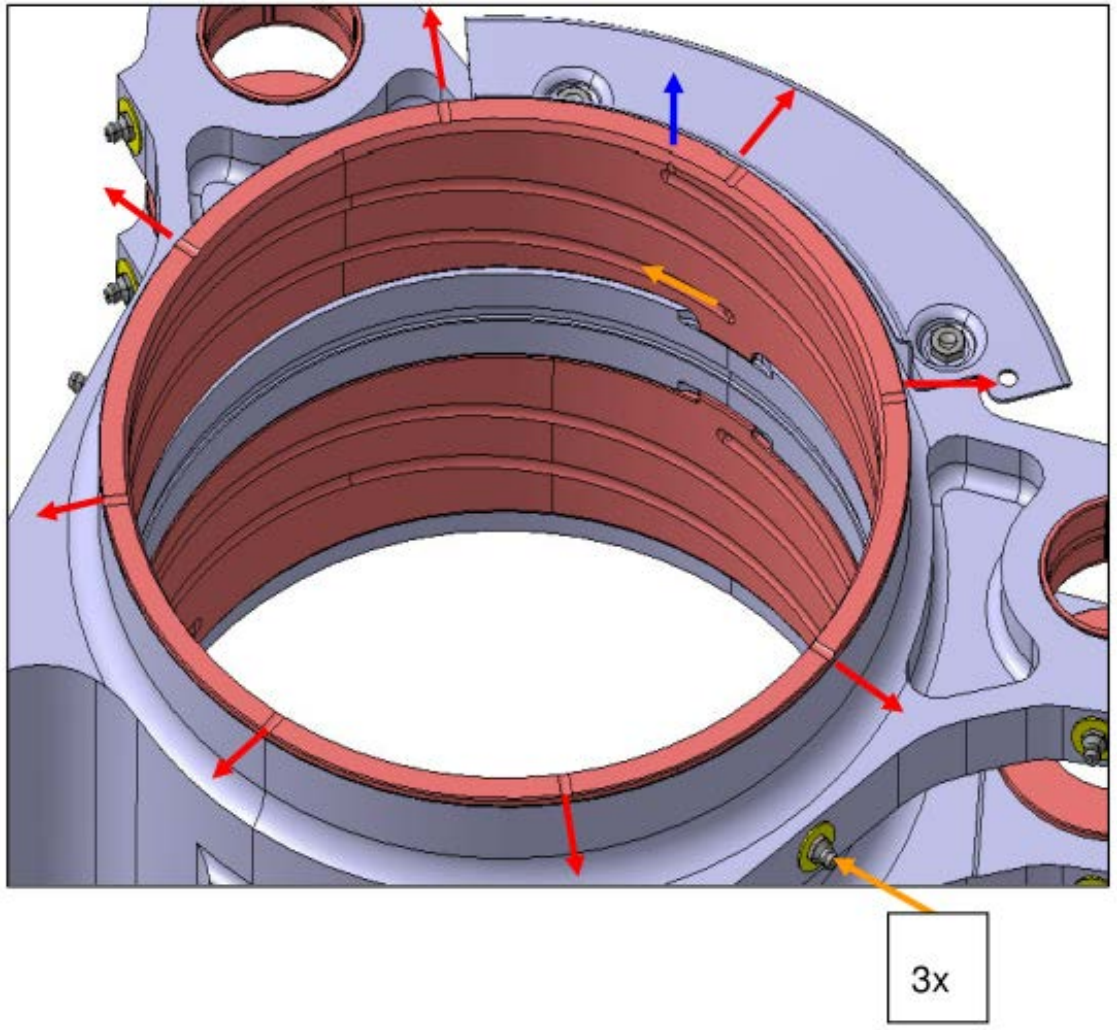


PICTURE 1

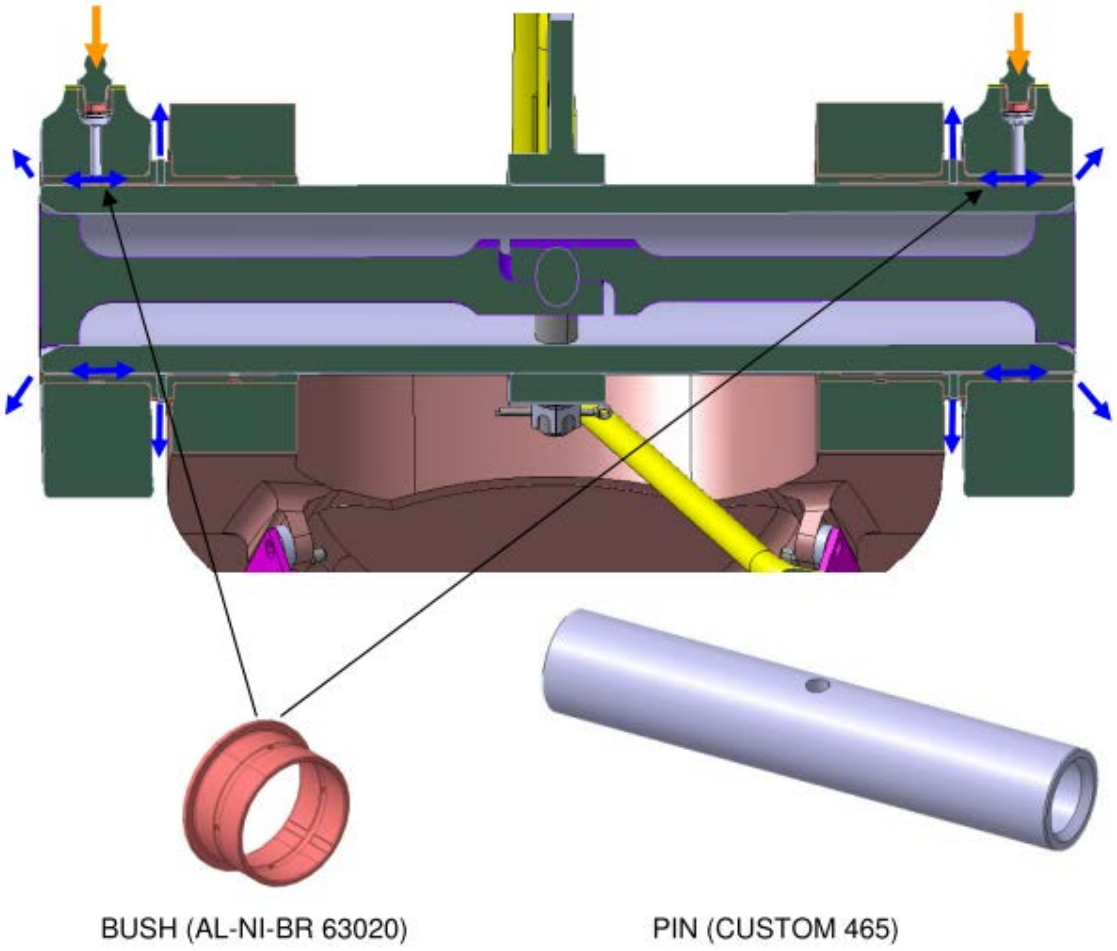


PICTURE 2

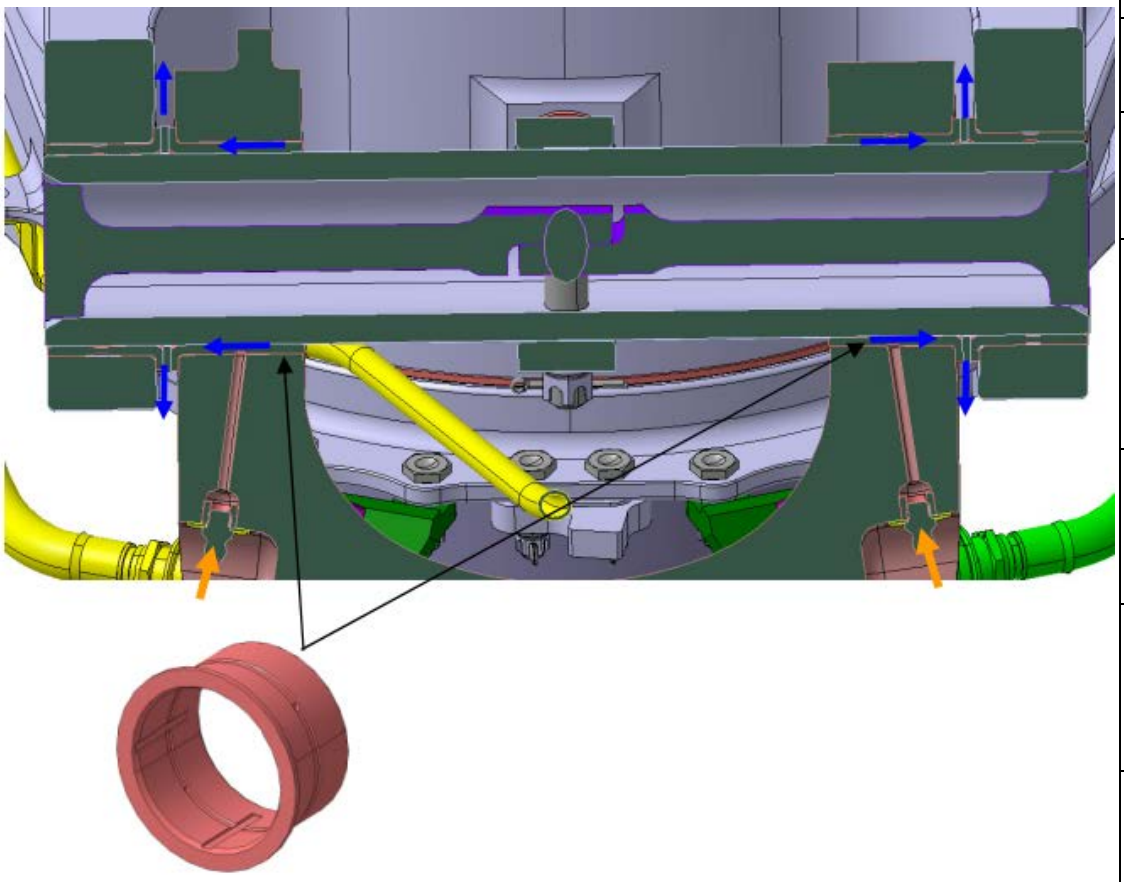
Ref. Number	2.8
Description	Steering Cuff (Dynamic joint grease – Upper bearing)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples (3x), each path is independent and does have a single grease entrance and witness, grooves (8x red arrows). Witness is than also guaranteed by a specific path on the upper bush (picture 1 and 2).
Grease distribution	Distribution is guaranteed by the independent helical grooves.
Accessibility	N/A
Comments	Light blue lines on picture 1 are representing sealing scrapers to protect the gear rim area from exhausted grease and debris coming from the cuff bushes area.



Ref. Number	2.8
Description	Steering Cuff (Dynamic Joint Grease – Lower bearing)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease will enter from the grease nipples, each path is independent and does have a single grease entrance and witness. Witness is than guaranteed by 8x (red arrows) grooves on the flange of lower bush.
Grease distribution	Distribution is guaranteed by the independent helical grooves.
Accessibility	N/A
Comments	

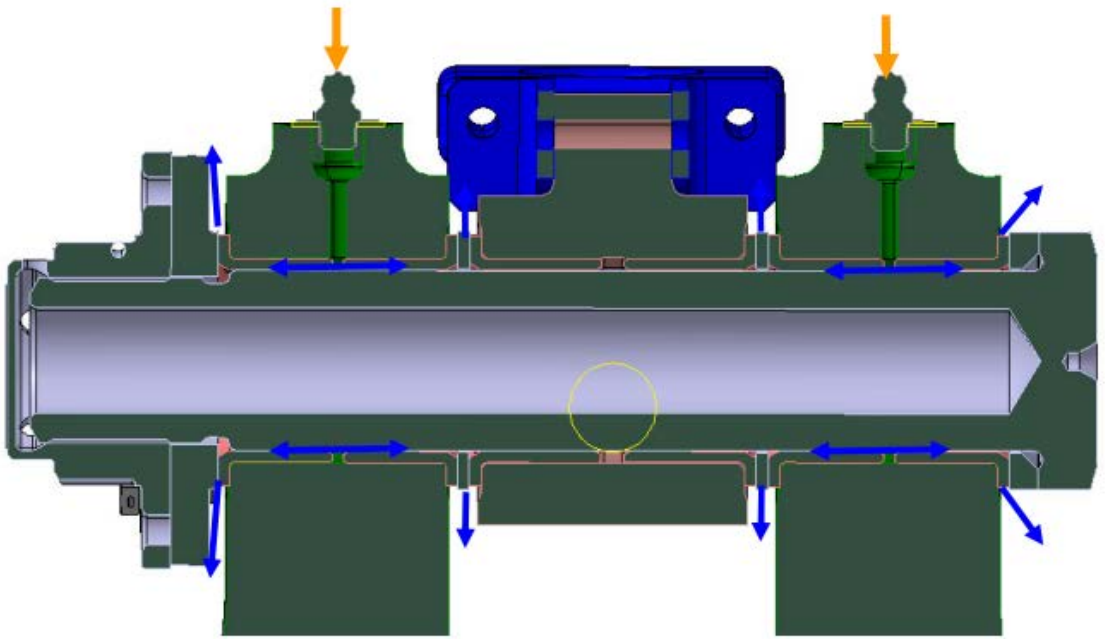


Ref. Number	2.9
Description	Upper torque link to cuff (Static Joint Grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from nipples will flow over the contact area and directly out, over the grooves for inspection.
Grease distribution	Grease will be distributed over the contact area by the grooves on the bushes.
Accessibility	N/A
Comments	



BUSH (AL-NI-BR 63020)

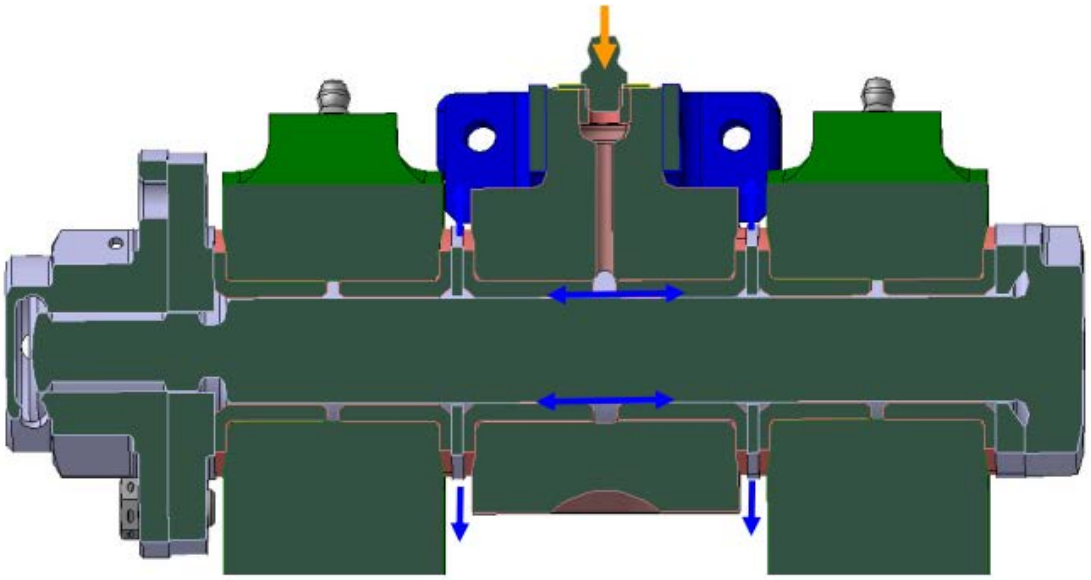
Ref. Number	2.9
Description	Upper torque link to cuff (Dynamic joint grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from nipples will flow over the contact area and directly out, over the grooves for inspection.
Grease distribution	Grease will be distributed over the contact area by the grooves on the bushes.
Accessibility	N/A
Comments	



BUSH (AL-NI-BR 63020)

PIN (CUSTOM 465)

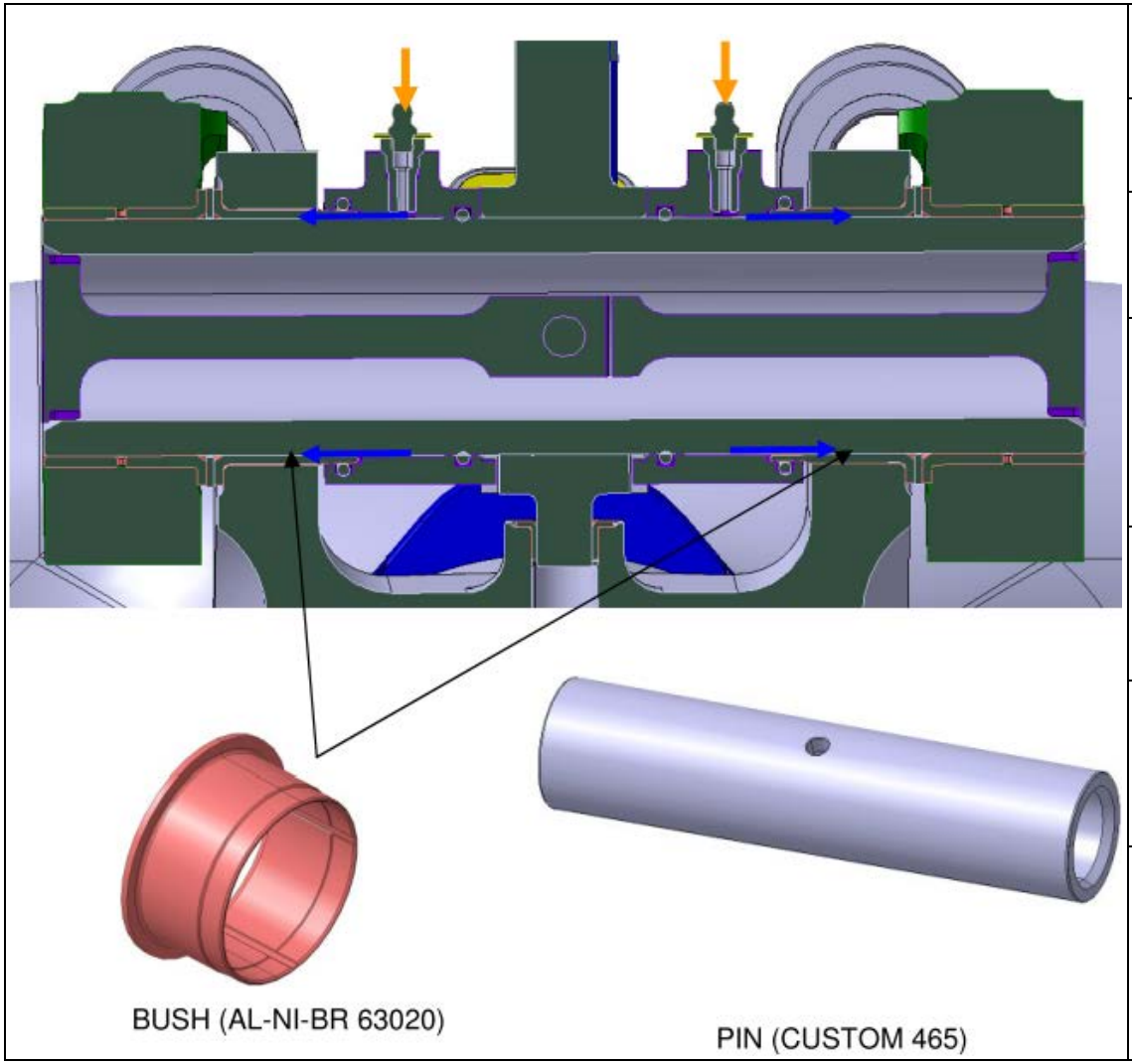
Ref. Number	3.0
Description	Apex pin: Troque links (Dynamic Joint grease / Upper torque link to pin)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from nipples will flow over the contact area and directly out, over the grooves for inspection.
Grease distribution	Grease will be distributed over the contact area by the grooves on the bushes and the gap in between.
Accessibility	N/A
Comments	



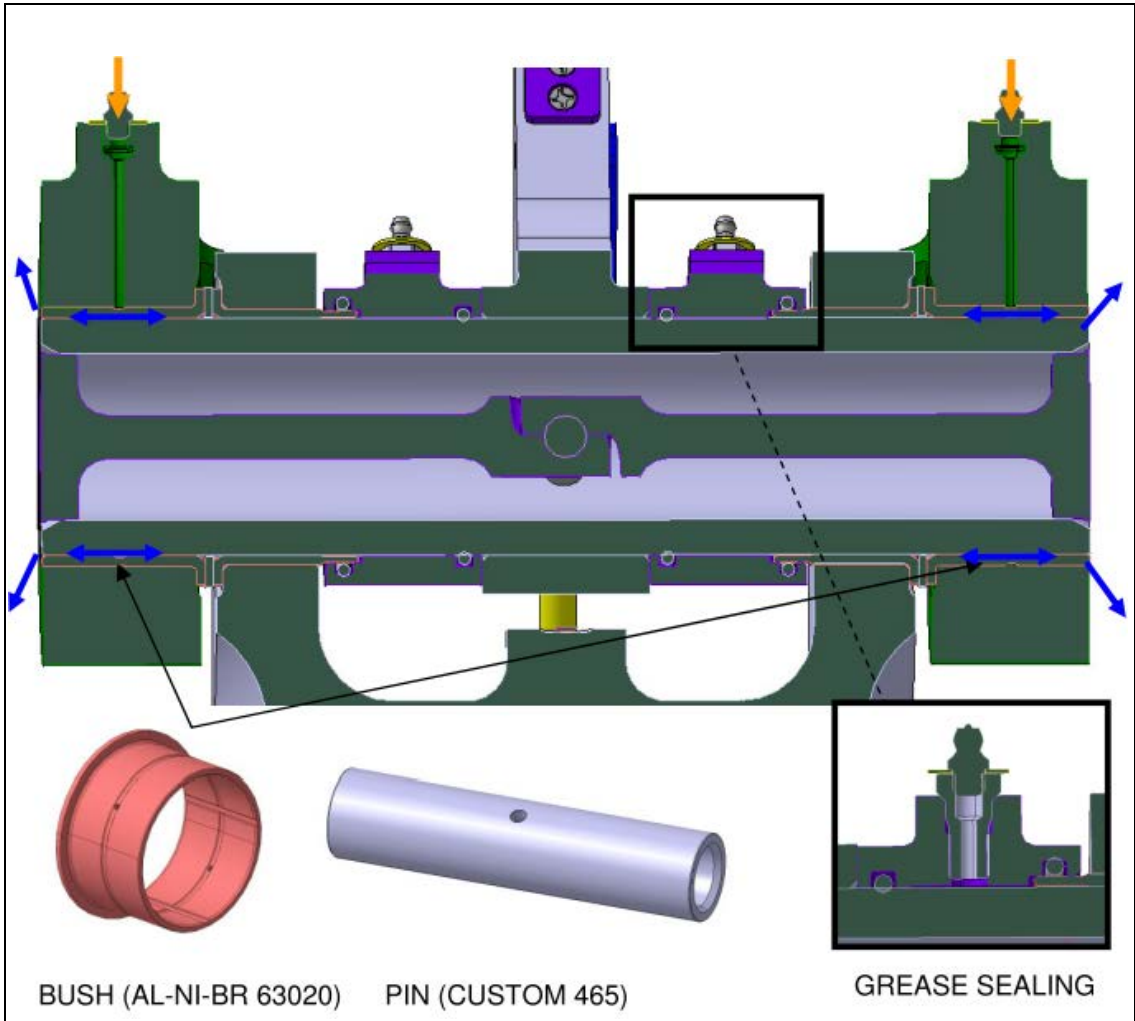
BUSH (AL-NI-BR 63020)

PIN (CUSTOM 465)

Ref. Number	3.0
Description	Apex pin: Torque links (Static Joint Grease / Lower torque link to pin)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from nipples will flow over the contact area and directly out, over the grooves for inspection.
Grease distribution	Grease will be distributed over the contact area by the grooves on the bushes and the gap in between.
Accessibility	N/A
Comments	



Ref. Number	3.1
Description	Lower Torque link to main fitting (Static joint Grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from nipples will flow over the contact area and directly out (one direction only), over the grooves for inspection.
Grease distribution	Grease will be distributed over the contact area by the grooves on the bushes and the gap in between.
Accessibility	N/A
Comments	



Ref. Number	3.1
Description	Lower torque link to main fitting (Dynamic joint grease)
Method of greasing	Grease will be applied directly from outside (grease nipples) by using a grease gun.
Grease entrance and witness	Grease entering from nipples will flow over the contact area and directly out, over the gap in between
Grease distribution	Grease will be distributed over the contact area by the grooves on the bushes and the gap in between.
Accessibility	N/A
Comments	

Dressing Assy

EFFECTIVITY:

ALL

03 Dec 2014

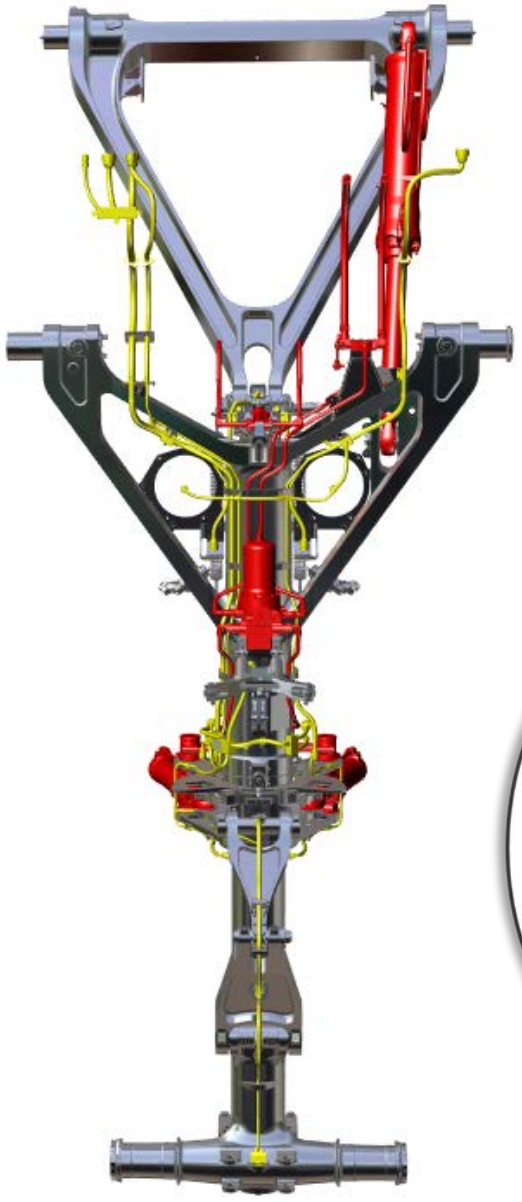
ELECTRICAL HARNESS AND HYDRAULIC PIPES

The hydraulic pipes provides the hydraulic pressure for the following functions.

- Steering Pressure Supply
- NLG Extension/Retraction
- Locking Stay Actuator

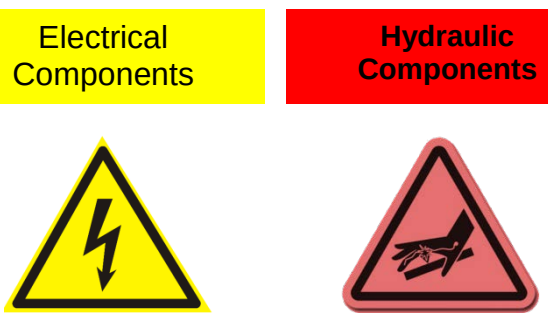
The Electrical Harness derived signals further to different Sensors and Valves.

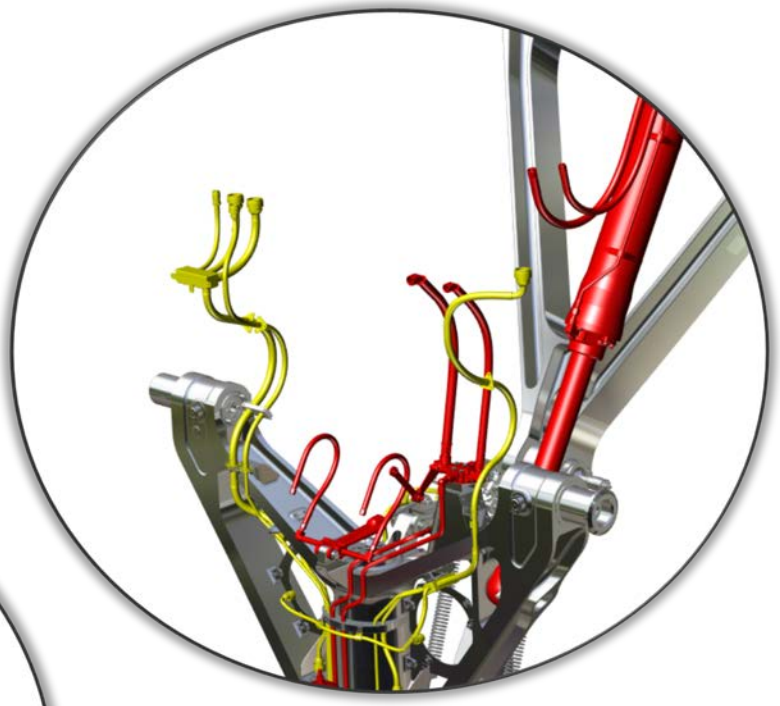
- Steering Feedback Sensors
- Taxi Landing Lights
- Weight on Wheel Sensors
- Steering Feedback Sensors
- Down and Locked Sensors
- Wheel Speed Sensors (No LLI Parts)

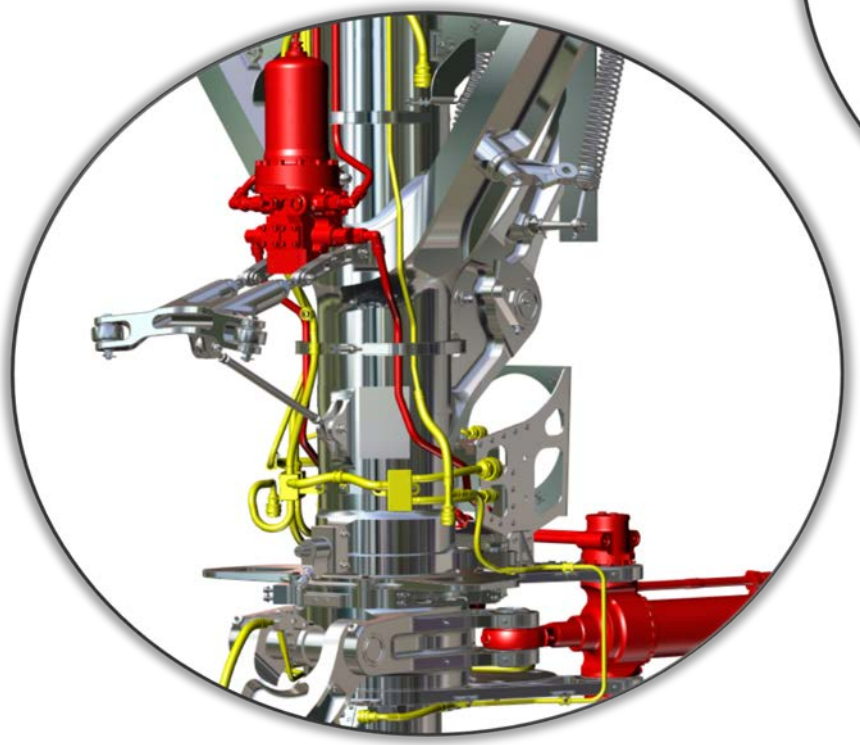


Electrical Components

Hydraulic Components







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Shock Strut Assy

EFFECTIVITY:

ALL

03 Dec 2014

SHOCK STRUT ASSY

The NLG shock strut supports the forward fuselage while the aircraft is on ground. The main structure has a telescopic shock strut that absorbs the landing impacts and the aircraft weight during taxing and ground handling.

The NLG shock strut is hinged on the fuselage structure.

The shock strut has:

- Main fitting
- Sliding tube and axle assembly
- Steering motor
- Torque links
- Sensors

General Description:

The main fitting and the sliding tube together operate as a spring and damper called shock absorber. The shock absorber reacts to loads and the aircraft movements resulting from:

- Take-off
- Landing
- Taxing

A pair of torque links connects the steering motor to the sliding tube and wheel axle and keeps the housing and sliding tube aligned on ground. Centering cams in the sliding tube and main fitting hold the NLG steering in the 0° position whenever the aircraft is not on ground.

The NLG is steered by a steer-by-wire system. It can be steered in normal mode (active steering) or free castor mode (passive steering). The steering system provides a shimmy damping function in the free castor mode.

The NLG steering will be enabled with a push-pull steering motor arrangement mounted on the lower tube section of the landing gear main fitting.

When the NLG shock strut is commanded to the up and locked position the internal cams center the strut. The wheel rotation is stopped by a tire-friction pad installed in the forward upper NLG bay.

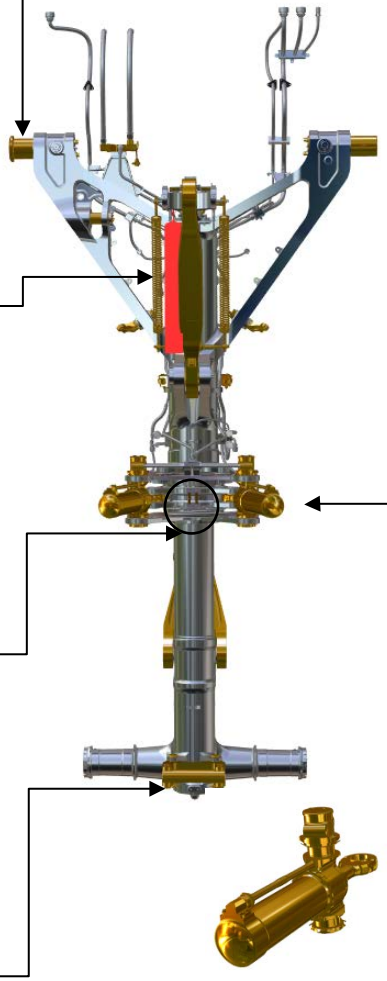
Pintle Pin RH

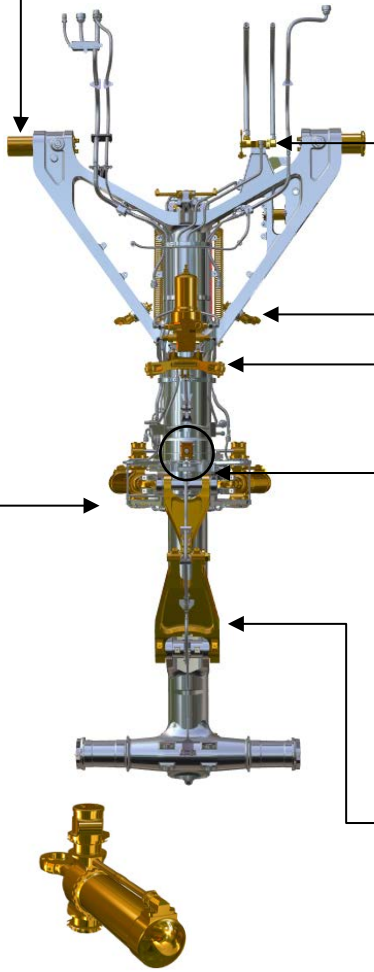
Front View

Back View

Pintle Pin LH

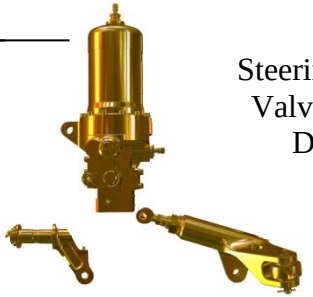
Downlock Springs





Steering Shut-Off Valve

Steering Over-Travel Indicator



Steering Hydraulic Valve Block and Door Stop

Towing Bar

Steering Cylinder and Steering Change-Over Valve

Torque Links

Change Over- and Hydraulic Fluid Filling

OPERATION OF THE NLG SHOCK STRUT

The shock strut is a telescoping strut where the sliding tube moves within the main fitting and is aligned by internal bearings. The lower bearing is fixed to the main fitting and the upper bearing moves dynamically with the motion of the sliding tube.

The cavities of the shock absorber contain oil and nitrogen. When the sliding tube compresses oil it is forced past a metering pin with tapered slots and four parallel orifices damping the speed of compression while reducing the volume and compressing the gas in the upper chamber.

Simultaneously the oil flows thru to the annular area via the recoil chamber flapper valve mounted between the main fitting and sliding tube and restrained by the upper bearing carrier.

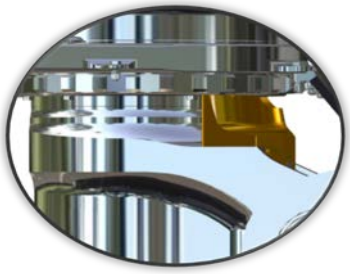
The recoil flapper valve is a continuous ring with a dynamic seal designed to restrict oil flow.

As the upper compressed gas extends the shock strut the recoil flapper valve reduces the extension orifice area and subsequently controls the extension rate.

The combination of the metering pin, parallel orifices and recoil orifice areas along with the gas spring controls the aircraft taxi ride comfort and landing performance. An in stroke stop face is provided between the sliding tube and the main fitting at full shock absorber closure.

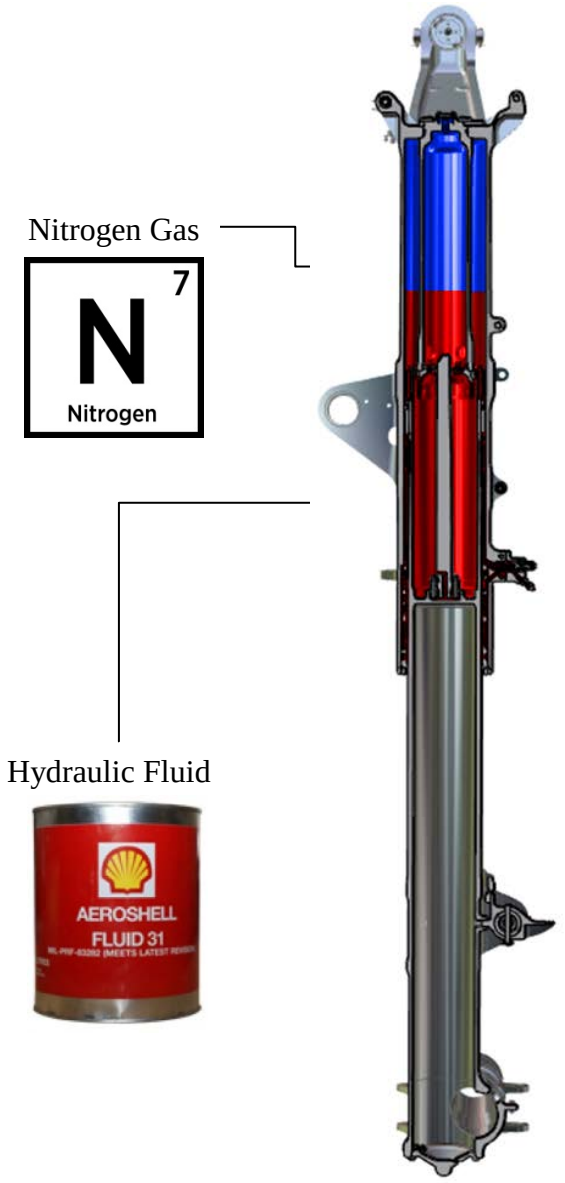
Shock Strut Extend

Shock Strut Retracted



External Bottoming Indicator

Oil and Nitrogen Separation



SHOCK STRUT

The Shock Absorber comprises od a Main Fitting, a Sliding Tube (piston) with integral axle, Upper and Lower Bearing carriers, Orifice Support Tube, Metering Pin, Upper and Lower Centering Cams, Upper and Lower Torque links, Cap-Jacking Pad, Towing Fitting, Lock link attachment lug, Downlock Release actuator attachment lug and provision for WOW sensors/targets.

The Shock Strut is a telescoping strut where the sliding tube moves within the Main Fitting and is aligned by internal bearings. The lower bearing is fixed to the Main Fitting and the Upper Bearing moves dynamically with the motion of the Sliding Tube.

The cavities of the shock absorber contain oil and nitrogen. When the sliding tube compresses oil it is forced past a metering pin with tapered slots and four parallel orifices damping the speed of compression while reducing the volume and compressing the gas in the upper chamber.

Simultaneously the oil flows thru to the annular area via the recoil chamber flapper valve mounted between the main fitting and sliding tube and restrained by the upper bearing carrier.

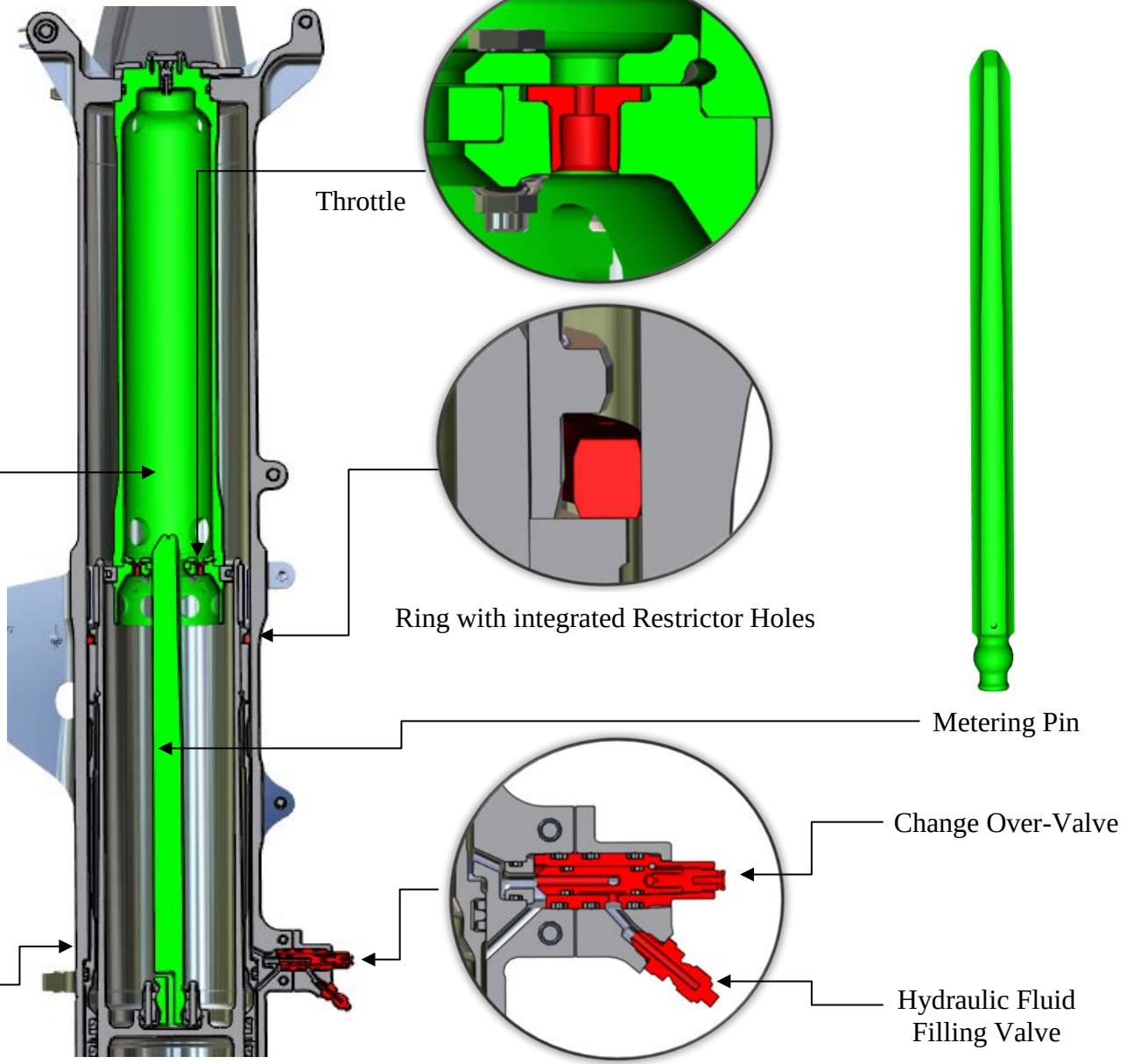
The recoil flapper valve is a continuous ring with a dynamic seal designed to restrict oil flow.

As the upper compressed gas extends the shock strut the recoil flapper valve reduces the extension orifice area and subsequently controls the extension rate.

The combination of the metering pin, parallel orifices and recoil orifice areas along with the gas spring controls the aircraft taxi ride comfort and landing performance.

An in stroke stop face is provided between the sliding tube and the main fitting at full shock absorber closure.

The stop pad protects the internal components in the event of a shock strut deflation at all aircraft weights without deformation as it is the first point of contact and sized for MRW.


Throttle
Ring with integrated Restrictor Holes
Metering Pin
Change Over-Valve
Orifice Support Tube
Main Fitting
Hydraulic Fluid
Filling Valve

MAIN FITTING

The right hand pintle pin is a flanged head design inserted from outside the wheel well and clamps the Main Fitting lug to the wheel well via a cross pin and collars retained by a bolt, nut and cotter pin.

The left hand pintle pin is inserted from inside the wheel well and held static in the Main Fitting by a cross pin and collars retained by a bolt, nut and cotter pin.

This arrangement allows for a gap between the Main Fitting and the side wall for structural flexing up to maximum limit load.

Both pintle pins interface with spherical bearings mounted in the wheel well side walls and form the retraction rotation axis.

Lubrication galleries within the pintle pins allow for the lubrication of the Airframe spherical bearings from within the landing gear wheel well.

Both pintle pins transmit vertical loads with the right hand pin transmitting horizontal loads to the airframe.

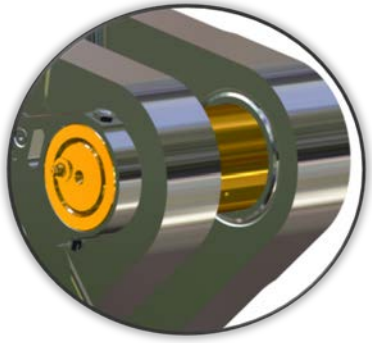
The Main Fitting is a double “Y” arrangement that has provision for the attachment of the:

- Take Off Lights
- Outside Air Temperature Sensor
- Retraction Actuator Rod End
- Lower Drag Brace Attachment
- Steering Motor Assembly
- The Steering Manifold
- The Mechanical Steering Shut-Off valve
- The Aft Lock Link
- Downlock Release Actuator plus all the necessary harness attachment brackets and internal component retention

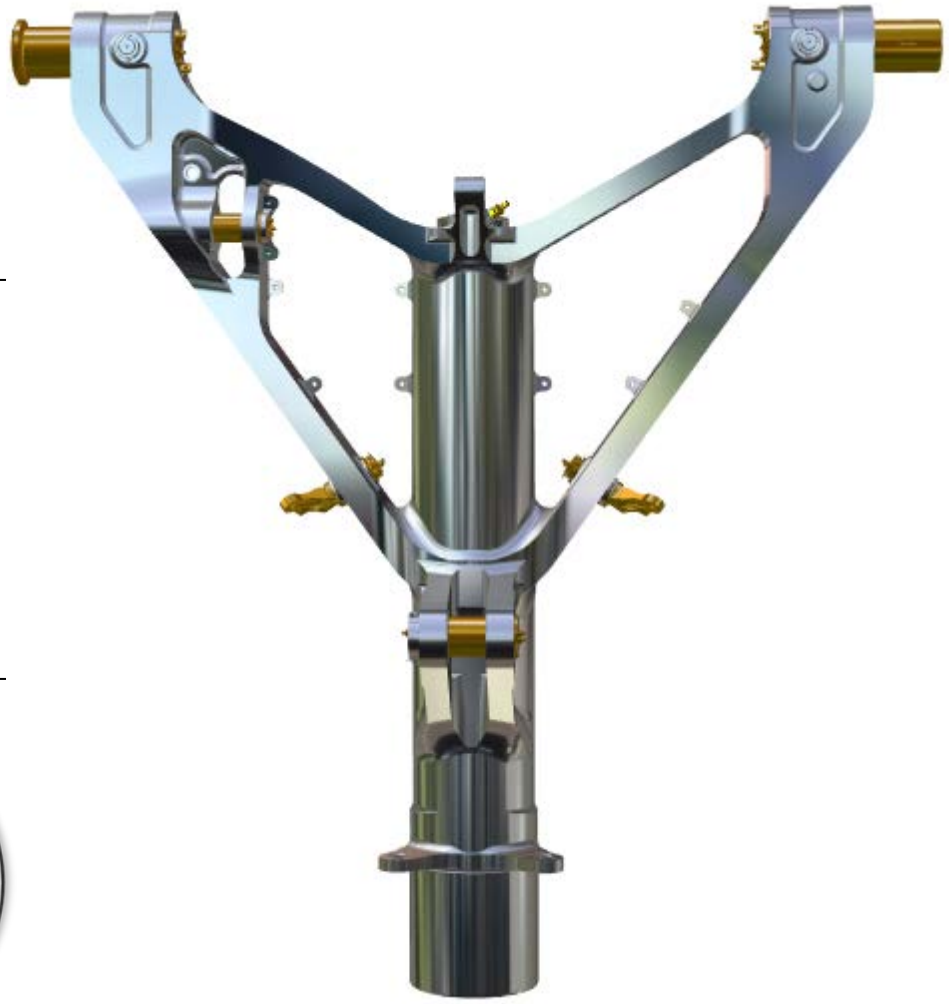
The Main Fitting lower “Y” arms have provision for the attachment of the aft door rods in line with the doors interface drawing.

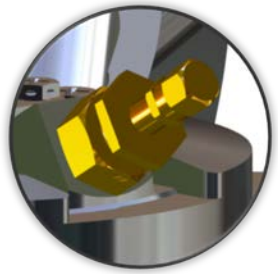
Left Hand Pintle Pin

Retraction Actuator Pin

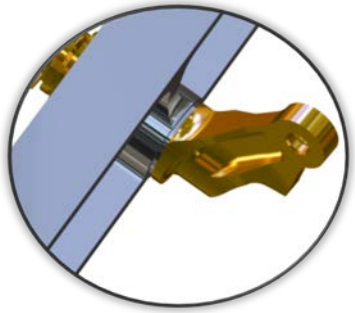


Lower Drag Brace Lock Link

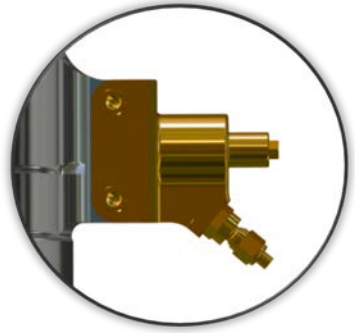




Nitrogen Filling Valve



Door Bold Assy



Change Over Valve

SLIDING TUBE

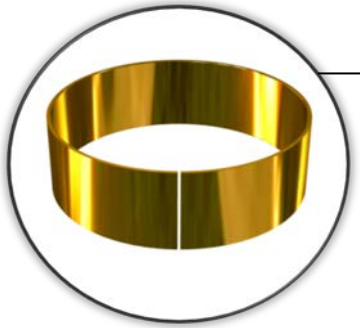
The Sliding Tube (Piston) is the part of the Shock Absorber that moves when the landing, take-off or taxi loads increase or decrease with HVOF coating on the outside diameter of the barrel section to provide a wear resistant coating.

The Sliding Tube has provisions for:

- Metering Pin
- Lower Torque Link attachment
- Lower Centering Cam
- Torque Link Support Bracket
- Towing Bracket attachment (forward and aft)
- Wheel attachment and retention

The axle is integral to the Sliding Tube.

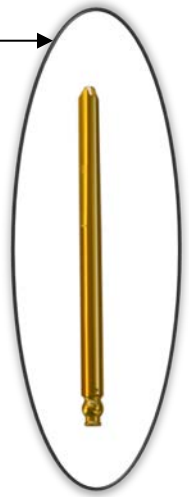
The bottom of the Sliding Tube incorporates a “jacking” point. This location allows for the use of a standard aircraft jack to be used to replace a damaged or deflated tire. Provision is made in the axle for interface with the axle equipment. The upper part of the Sliding Tube carriers the Upper Bearing and Upper Centering Cam on the outside diameter.

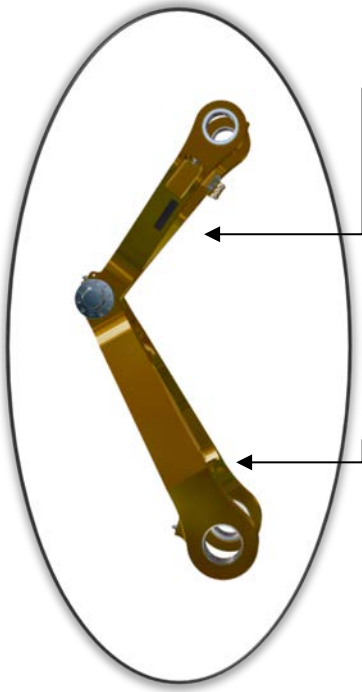


Upper Bearing

Back View

Front View





Towing Bar

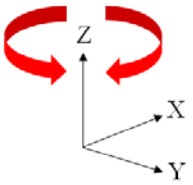
UPPER AND LOWER CENTERING CAMS

The Upper Centering Cam is located and locked to the Sliding Tube below the Upper Bearing carrier. The Cam orientation is achieved by dowel pins inserted between Sliding Tube outside diameter and the Cam inner diameter.

The Lower Centering Cam profile is integrally machined into the upper portion of the Upper Bearing Carrier.

The NLG axle orientation WOW is controlled via internal Centering Cams. These lock the Sliding Tube in the forward position when the sliding tube is fully extended to facilitate safe retraction and landing. The Centering Cams are designed to accommodate the ±0.5 degrees steering rotation during pre-landing BITE, without sustaining damage. The Centering Cams are fully disengaged at 80 mm Shock Absorber travel.

Sliding Tube Mechanical Fixed



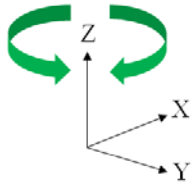
→ Upper Centering Cam

-mechanical fixed on sliding tube assembly

→ Lower Centering Cam

-mechanical fixed on main fitting housing

Sliding Tube Free to Rotate



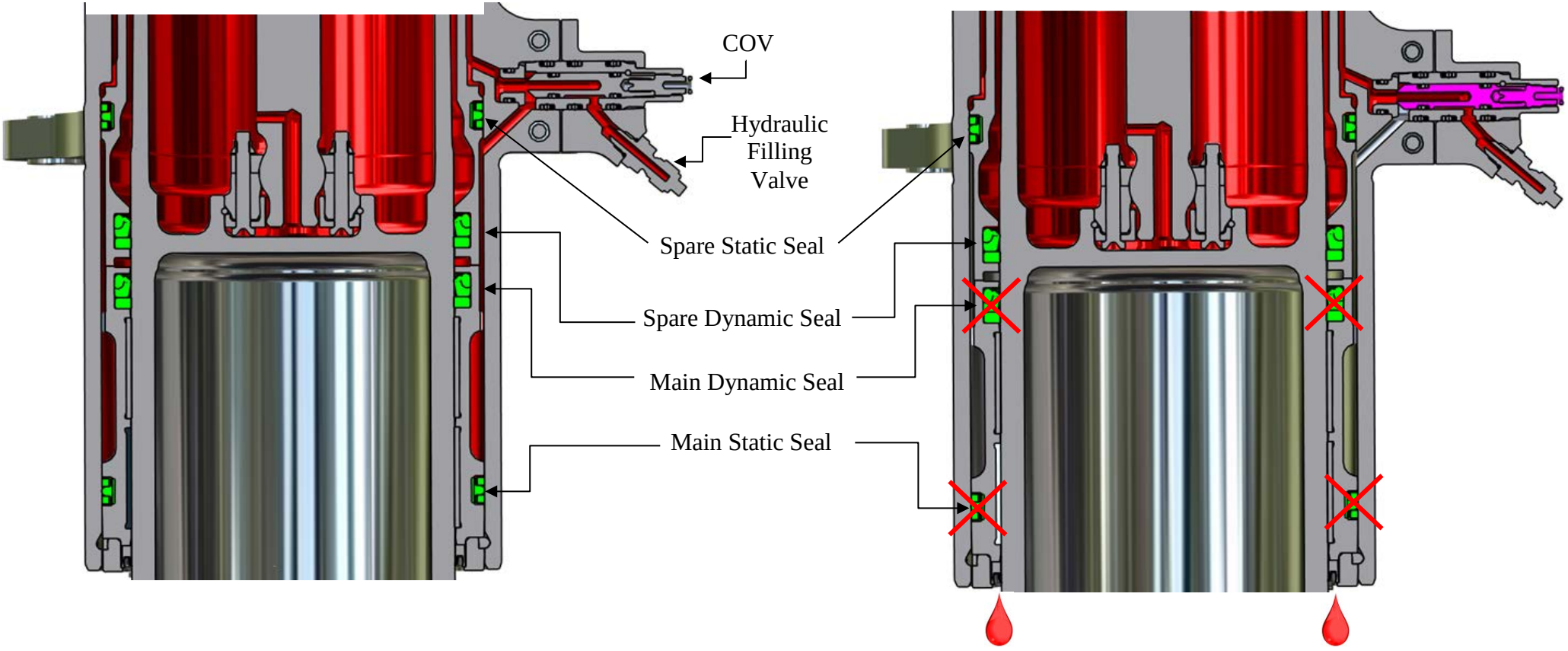
CHANGE OVER VALVE

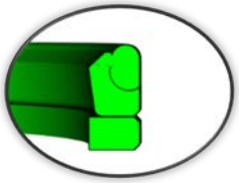
The dynamic seal Change over Valve (COV) is located near the bottom of the Main Fitting just above the steering motor and facing aft.

This location provides easy access and visibility of the valve with good protection.

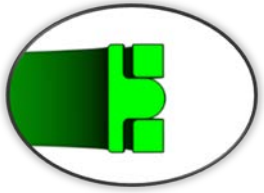
The change over valve is manually activated to energise the secondary seal by rotating clockwise. The action of unscrewing (clockwise) the activation screw exposes an area of the screw painted red to indicate secondary seal activation.

Abnormal Operation
(Example: Defect of Dynamic or Static Main Seal/
COV is Activated = External leakage)





Dynamic Seals:
The dynamic seal needs to resist the movement of the sliding tube.



Static Seals:
No relative movement between the parts.

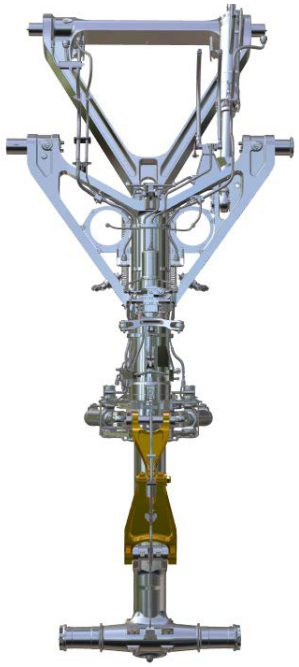
TORQUE LINK

The Torque Links are attached to the Steering Collar assembly and the Sliding Tube. They keep the Sliding Tube correctly aligned and supply steering inputs to the nose wheels.

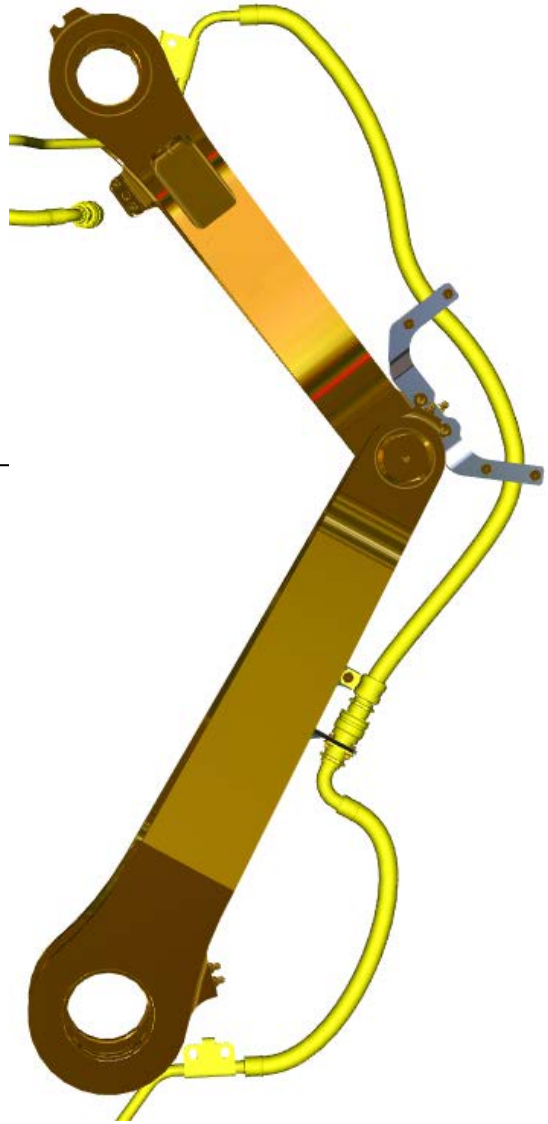
The Upper Torque Link is attached to the Steering Collar and the Lower Torque Link is attached to the Sliding Member. The Torque Links are designed to react the torque about the vertical center line in the event of unequal wheel loading when turning the aircraft. The torque is transmitted through the steering mechanism back to the Main Fitting. The Torque Links can be disconnected for maintenance operations (e.g. maneuvering into a hangar).

The Upper Torque Link is manufactured from Titanium Alloy forging.

The Lower Torque Link is manufactured from Aluminum Alloy.



Side View



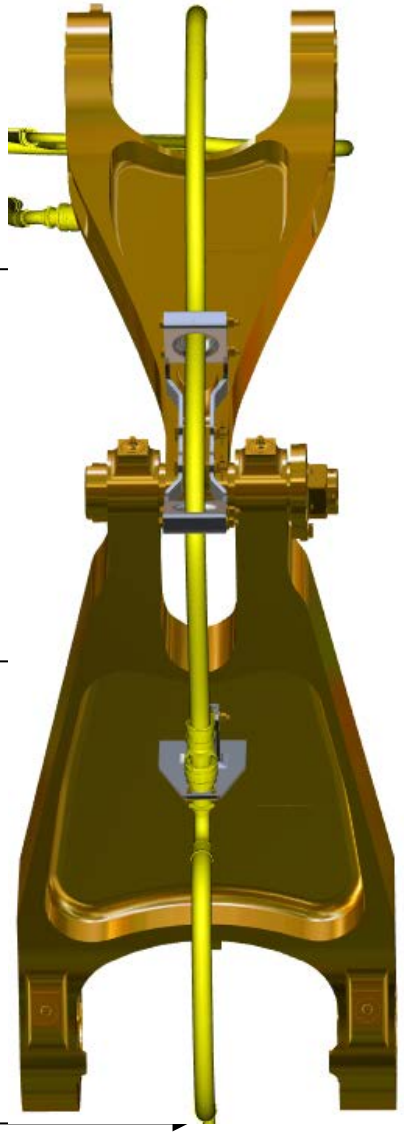
Upper Torque Link

Wiring Guides

Lower Torque Link

Wiring for Wheel Speed Transducer

Back View



Torque Link Apex Pin

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Drag Stay Assy

EFFECTIVITY:

ALL

03 Dec 2014

DRAG BRACE ASSEMBLY

The Drag Brace Assembly mounts between the wheel well in the NLG Bay and forward facing clevis on the Main Fitting. The Drag Brace Assembly consists of an Upper and Lower Drag Brace, Forward and Aft Lock Links, Lock Springs and provision for Down Lock Sensors.

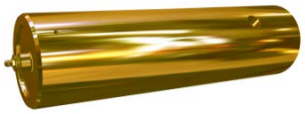
The Upper and Lower Drag Brace components are connected via an Apex Pin which also acts as the Forward Lock Link attachment and Uplock Roller carrier. With the Drag Brace down and locked, the apex is 10 mm over center forward.

The Upper Drag Brace is manufactured from Aluminum Alloy forging and is attached to the aircraft structural spherical bearings by inboard or outboard retracting Pintle Pins. The pins are prevented from rotating in the Upper Drag Brace by cross bolts, locknuts and cotter pins.

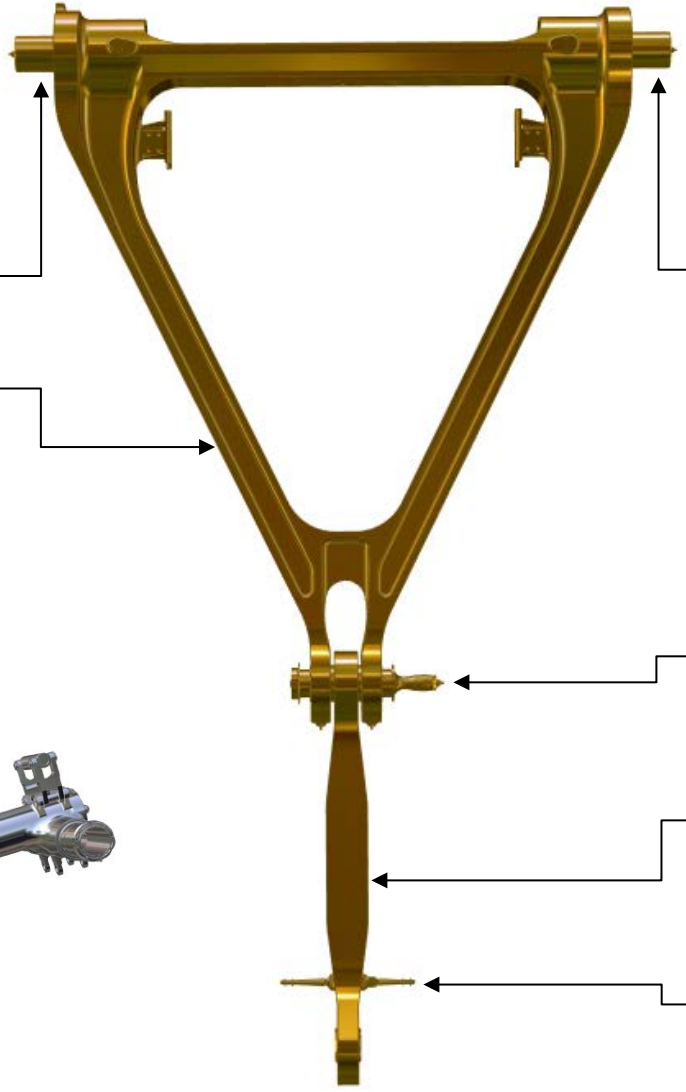
Lubrication galleries within the Pintle Pins allow for the lubrication of the Airframe Spherical Bearings from within the Landing Gear wheel well.

The Lower Drag Brace is manufactured from Titanium Alloy forging and includes a spherical split ball bearing at the Main Fitting attachment and has provision for the Lock Spring attachment.

The Torque Link Assembly consists of the Forward and Aft Lock Links, which are both manufactured from Aluminum Alloy forging and are attached together via an Apex Pin.



LH Drag Brace Pintle Pin

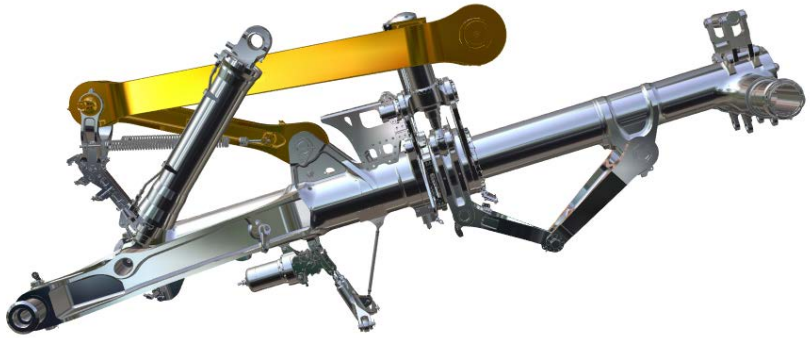


Upper Drag Brace

RH Drag Brace Pintle Pin

Drag Brace Apex Pin

NLG fully retraced



Lower Drag Brace

Bolt
(Lower Attachment Point for Downlock Springs)

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Retraction Actuator

EFFECTIVITY:

ALL

03 Dec 2014

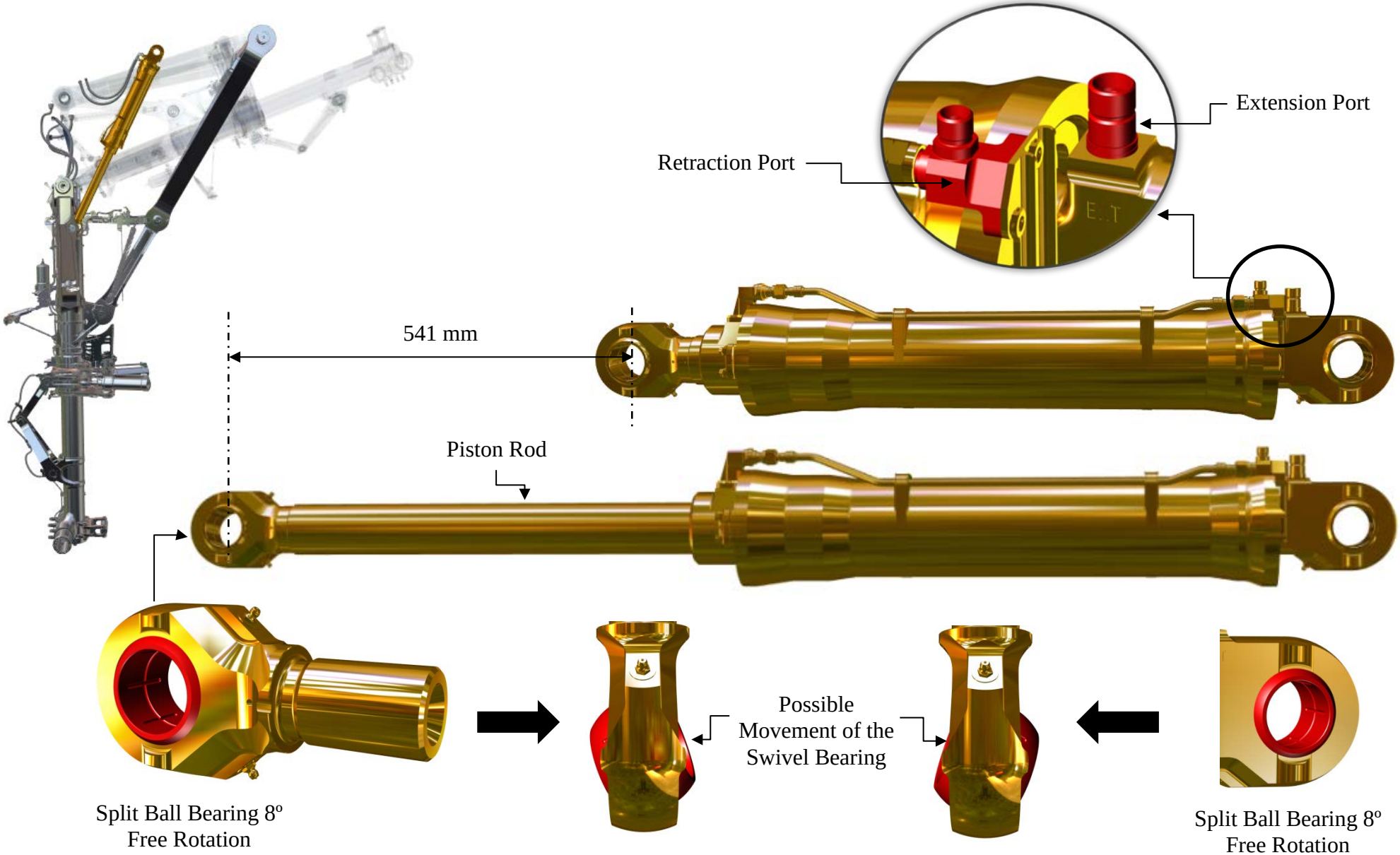
INTRODUCTION

The Retraction Actuator comprises of a cylinder, Head end cap, Bearing (Gland), Piston and a Self Aligning Rod End.
The Retraction Actuator is a conventional unbalanced double acting actuator.

The Self Aligning Rod End bearing is secured to the NLG Main Fitting via a clevis between the Upper and Lower “Y” member. The actuator has a split ball spherical bearing arrangement at the head end and at the rod end.

The hydraulic flexible hose connections are loacted at the head end of the actuator. The hydraulic connections are different sizes to prevent inadvertent cross connection. The ports are identified EXTEND and RETURN.

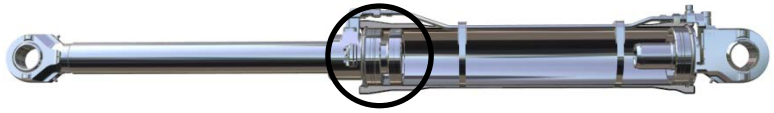
The Retraction Actuator has internal retract and extend snubbing. The snubbing limits the actuator velocity to slow the Landing Gear extension and retraction to 3°/sec (nominal) for the final travel into the relative lock position. Additional fixed orifice restrictors in the port adaptors control the extend and retract speeds outside of the snubbing range.


Extension Port
Retraction Port
541 mm
Piston Rod
Split Ball Bearing 8º
Free Rotation
Possible
Movement of the
Swivel Bearing
Split Ball Bearing 8º
Free Rotation

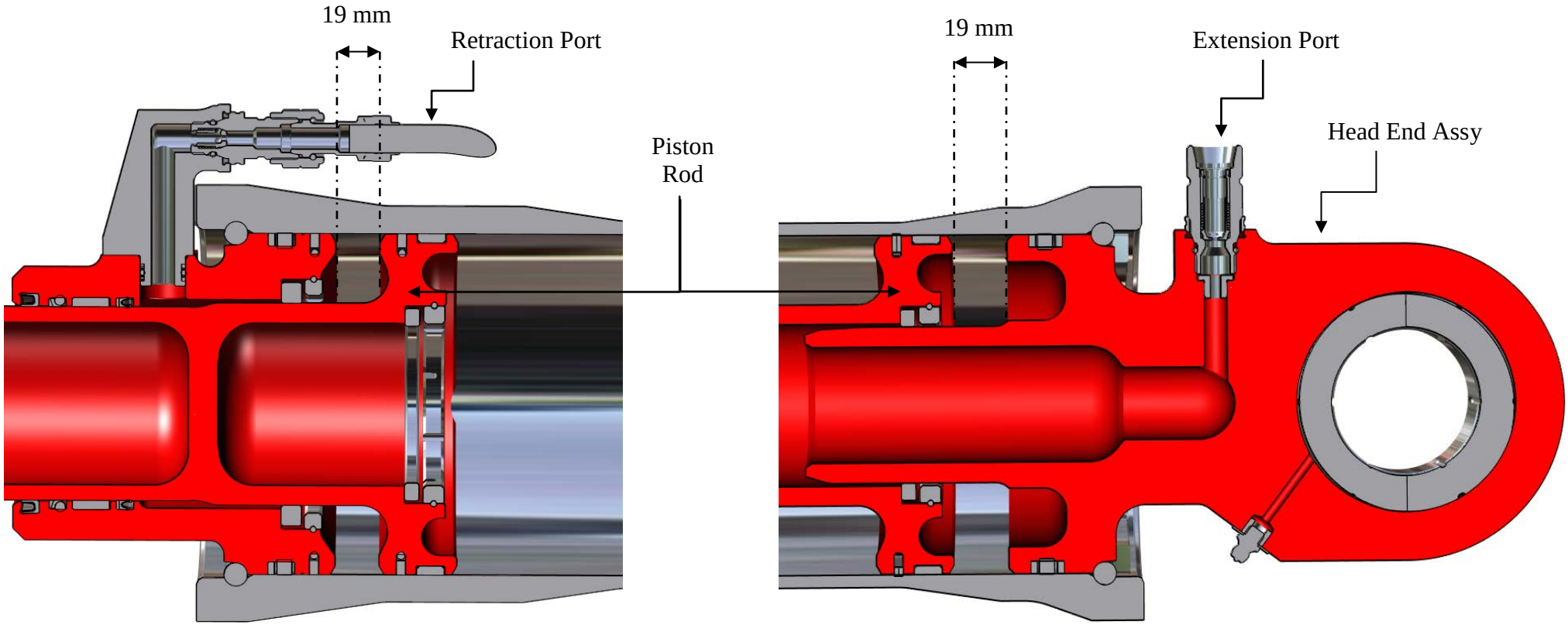
OVER-TRAVEL PROTECTION

The Retraction Actuator includes a nominal over-travel of 19 mm at the nominal extended and retracted position to protect the inner parts of mechanical demolition in case of an NLG over-travel retraction/extension.

Over-travel by Retraction

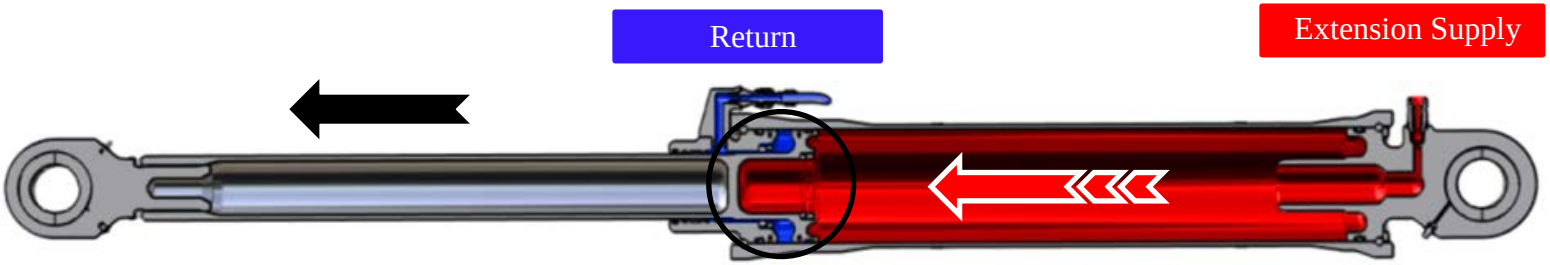


Over-travel by Extension



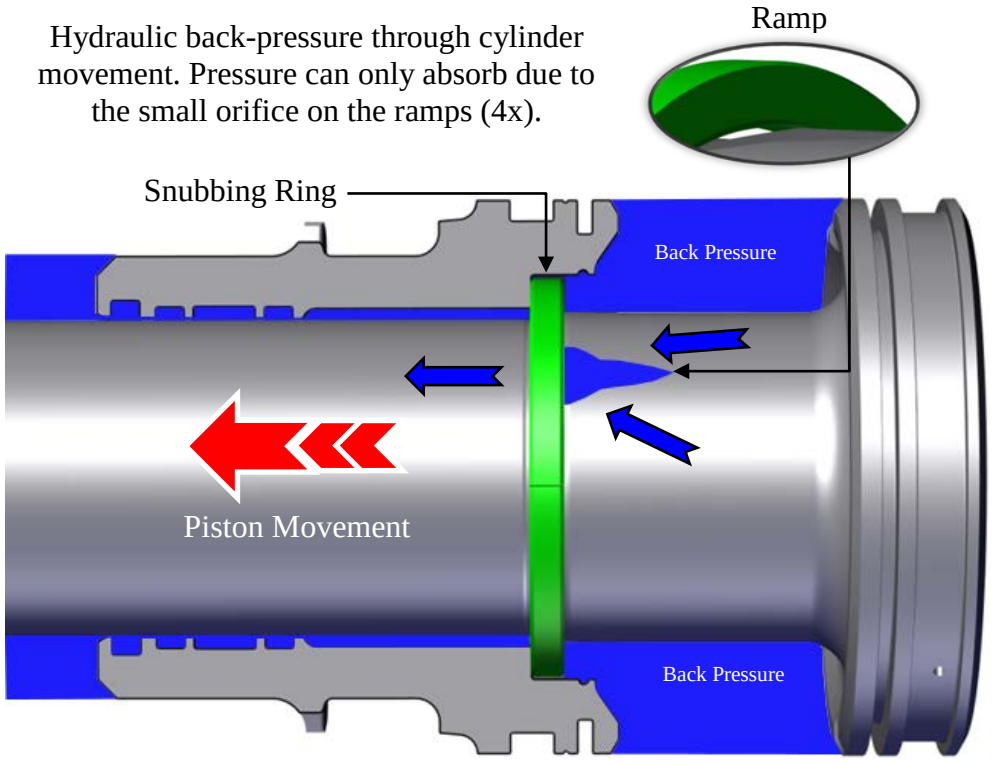
SNUBBING EXTENSION

The Retraction Actuator snubbing ring and lock ring are installed on decicated recess on the gland bush. They are used to reduce the oil flow and than the retraction actuator extension linear speed; they are installed free floating (horizontally) in order to guarantee oil flow in the opposite direction.



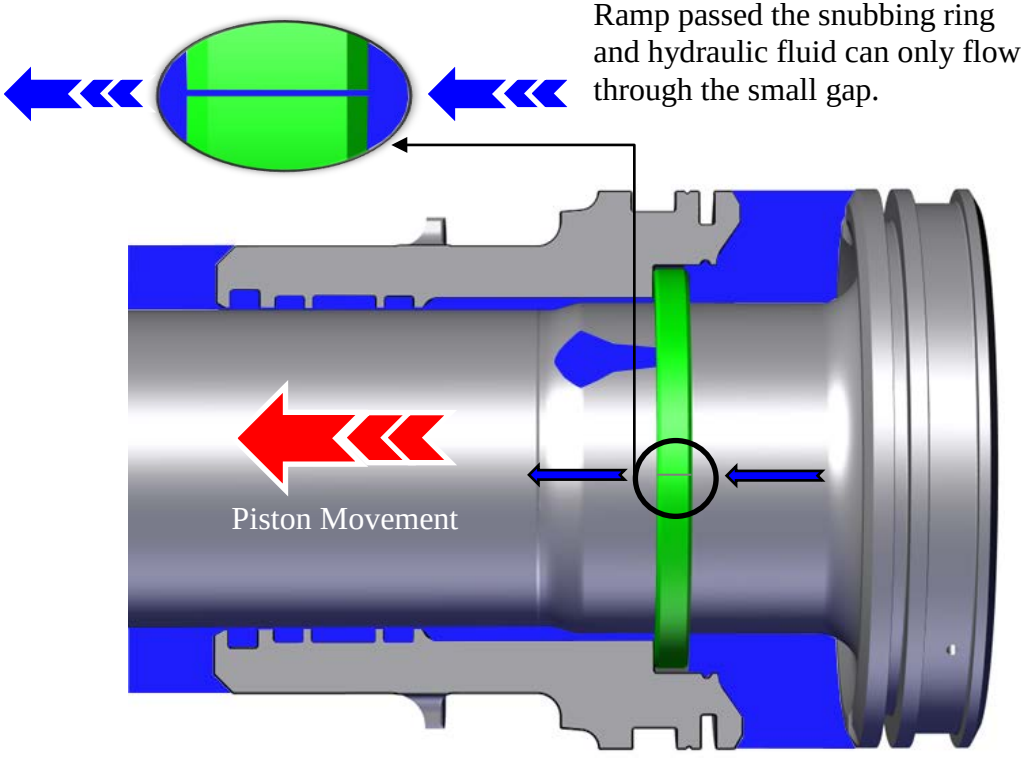
First Brake Stage

Hydraulic back-pressure through cylinder movement. Pressure can only absorb due to the small orifice on the ramps (4x).



Second Brake Stage

Ramp passed the snubbing ring and hydraulic fluid can only flow through the small gap.



SNUBBING RETRACTION

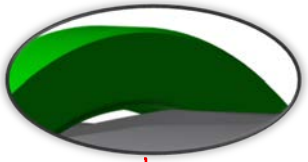
The Retraction Actuator snubbing ring and lock ring are installed on decicated recess on the gland bush. They are used to reduce the oil flow and than the retraction actuator retraction linear speed; they are installed free floating (horizontally) in order to guarantee oil flow in the opposite direction.

Retraction Supply

Return

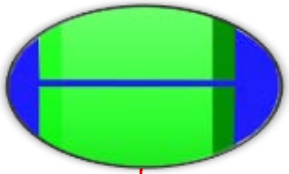
First Brake Stage

Hydraulic back-pressure through cylinder movement. Pressure can only absorb due to the small orifice on the ramps (3x).

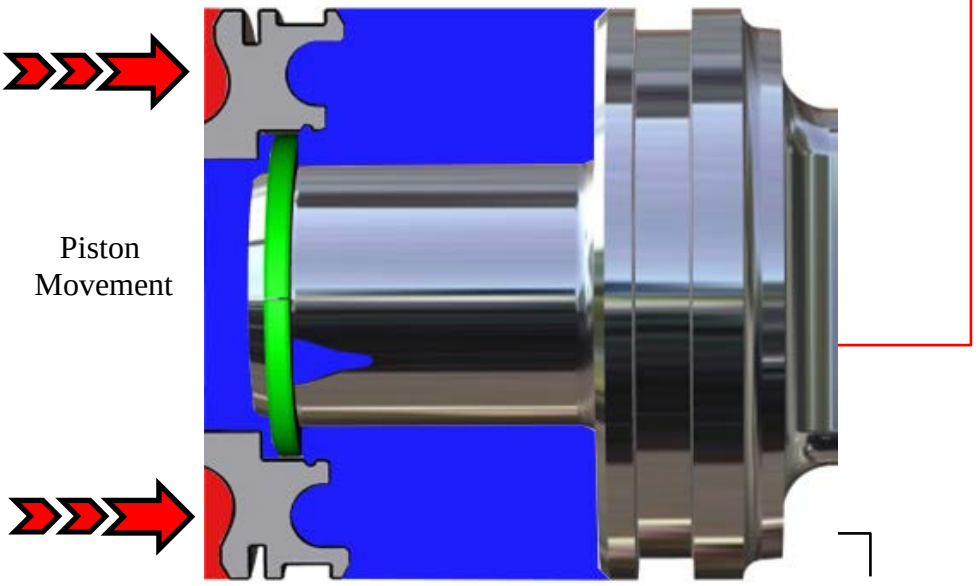


Second Brake Stage

Ramp passed the snubbing ring and hydraulic fluid can only flow through the small gap.



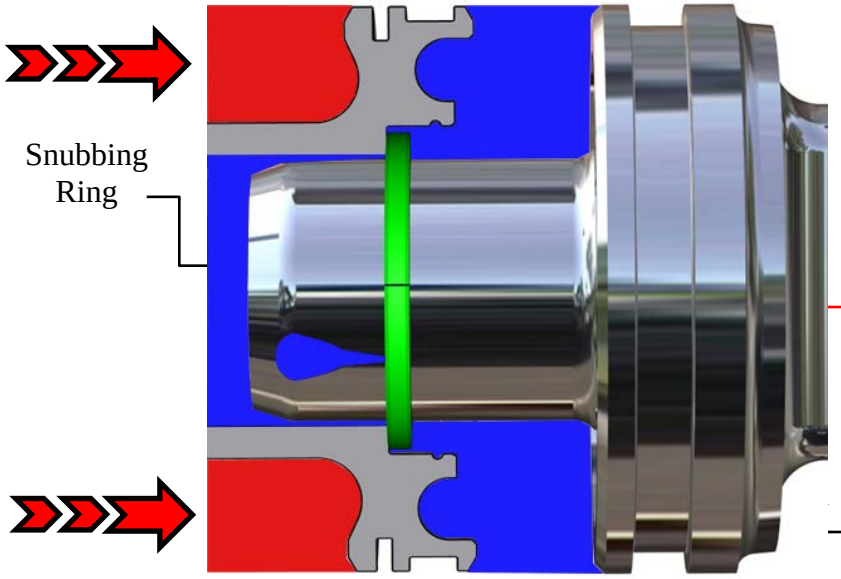
Snubbing Ring



Piston Movement

Head End Assy

Snubbing Ring



Head End Assy

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Locking Stay and Locking Stay Actuator

EFFECTIVITY:

ALL

03 Dec 2014

INTRODUCTION

Locking Stay:

The locking stay is a two piece hinged strut. It locks the drag brace in the extended position and folds the drag brace during retraction. Surfaces on the upper and lower locking stay parts provide an over-center stop position.

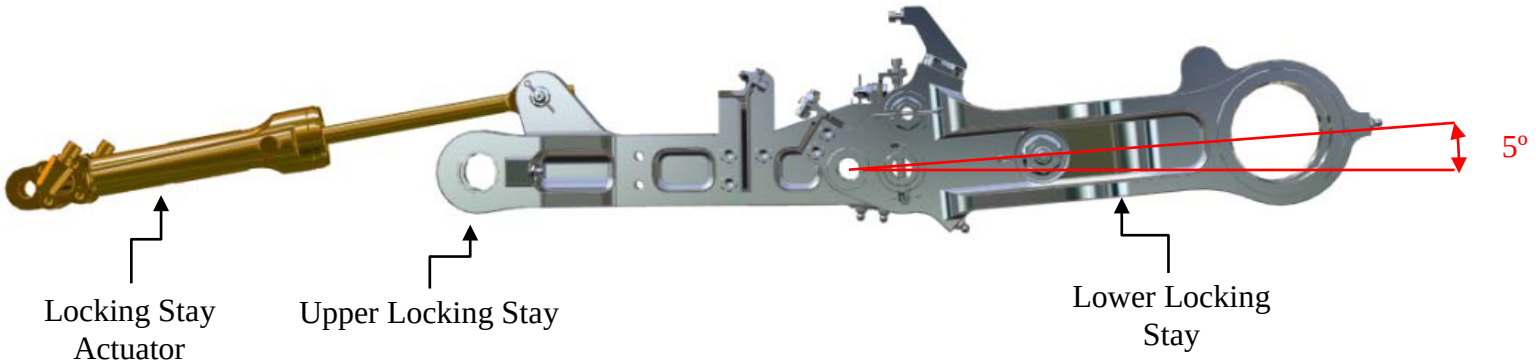
The locking stay has an upper and a lower part made from forged aluminium. The two parts have a hinge pin connection in the middle. The upper part attaches to a mounting lug on the shock strut and the lower part attaches to the hinge connection of the drag brace.

The locking stay has three proximity sensors. These sensors transmit a signal to the LG control computer when the NLG is locked in the fully extended position.

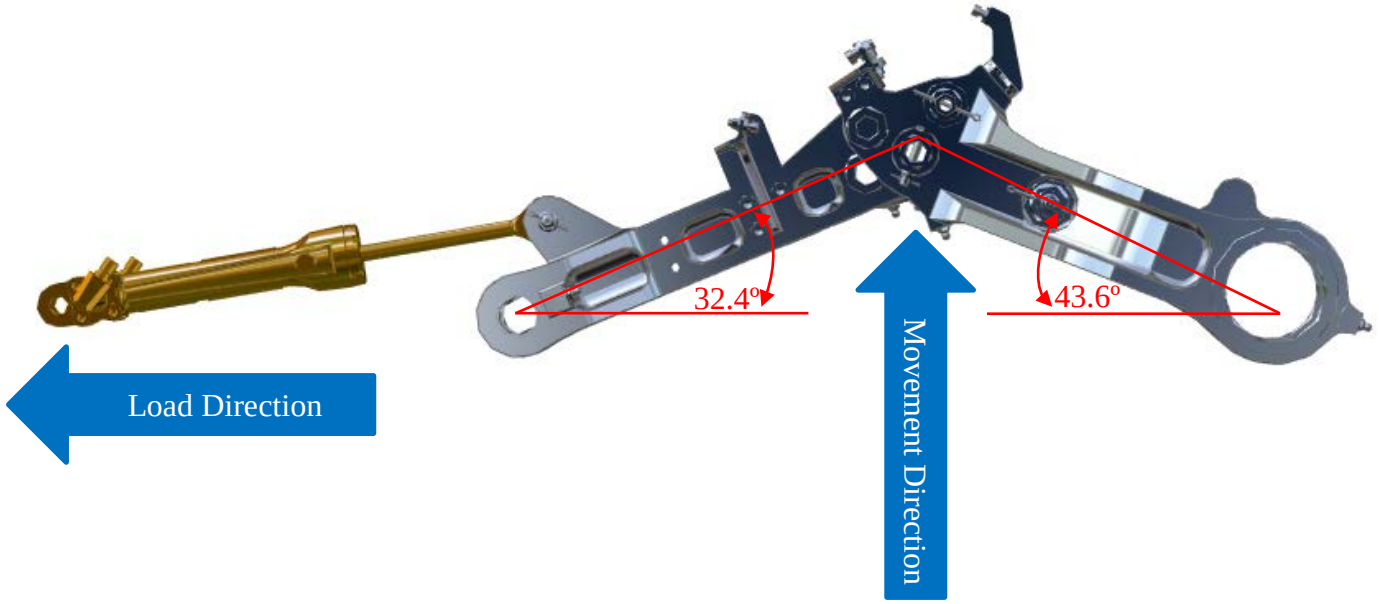
Locking Stay Actuator:

The locking stay actuator uses hydraulic pressure to overcome the downlock spring force and over-center position of the locking stay before the NLG can be retracted.

Over-Center Position



Transit Position (MAX)

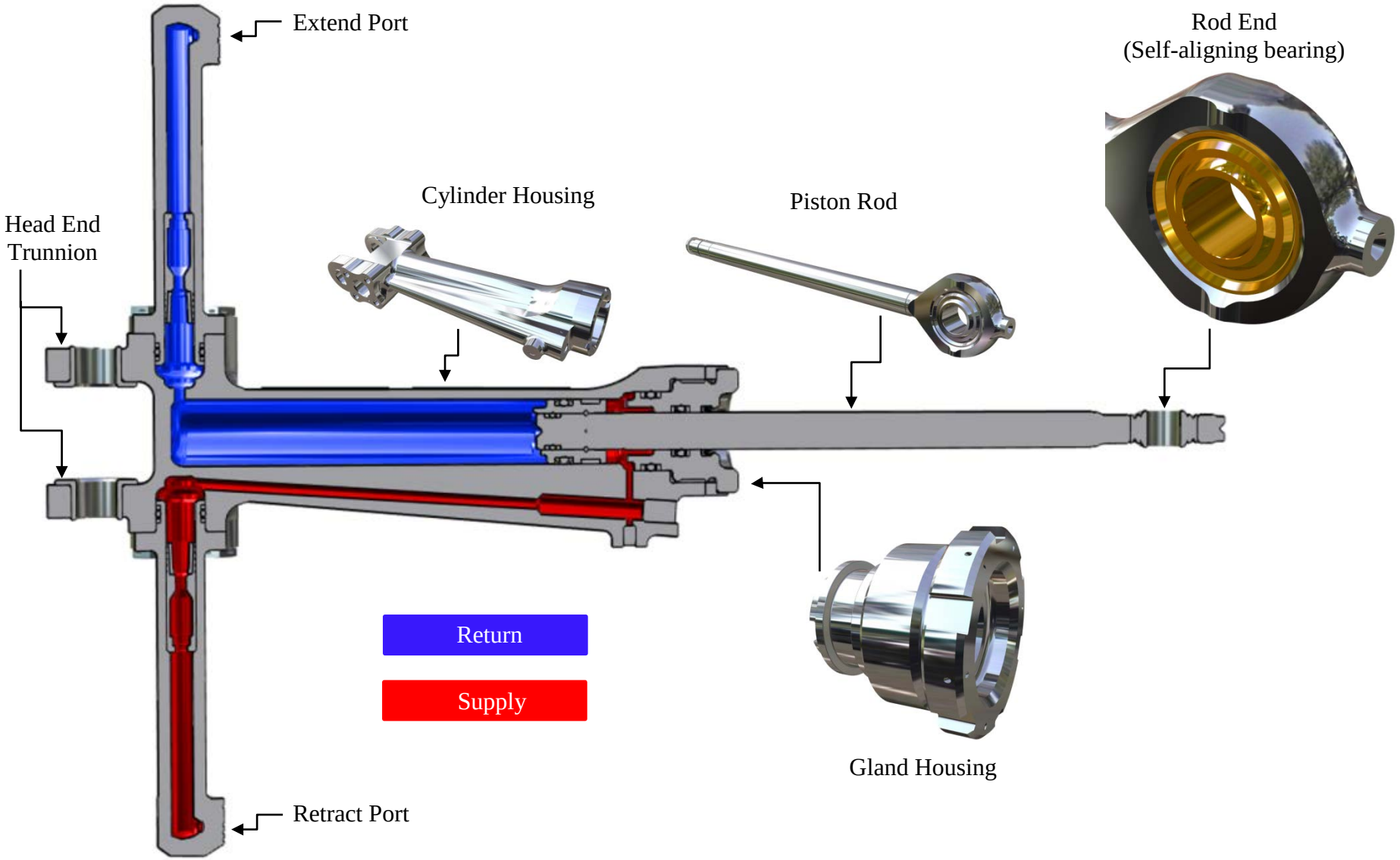


LOCKING STAY ACTUATOR

The locking stay actuator is a double-acting hydraulic cylinder. The cylinder housing is attached to the main fitting housing and the piston rod is attached to the forward part of the locking stay.

The Actuator is a conventional unbalanced double acting actuator with the Cylinder Head being a Trunnion design which engages the lug plates incorporated into the NLG Main Fitting. The Self Aligning Rod End is a standard “swaged” self lubricated bearing secured to the Aft Lock Link via the Lock Link integral clevis.

The hydraulic connections are the same size. Hose length and external hose guides prevent inadvertent cross connection. The ports are identified EXTEND and RETURN.


Extend Port
Rod End
(Self-aligning bearing)
Cylinder Housing
Piston Rod
Head End
Trunnion
Return
Supply
Gland Housing
Retract Port

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Nose Wheel Steering

EFFECTIVITY:

ALL

03 Dec 2014

INTRODUCTION

The NLG is equipped with a push-pull steering motor arrangement mounted on the forward face of the landing gear main fitting.

The push-pull steering system is equipped with an internal feature for shimmy damping within the control manifold and provides a powered steering range of 75° ±5° transmitted via the steering cuff through links to the Sliding Tube/Axle. The steering Actuator has got an internal end-stop at 80° (bottoming). The steering Motor is designed to fulfil a steering rate of 15° per second.

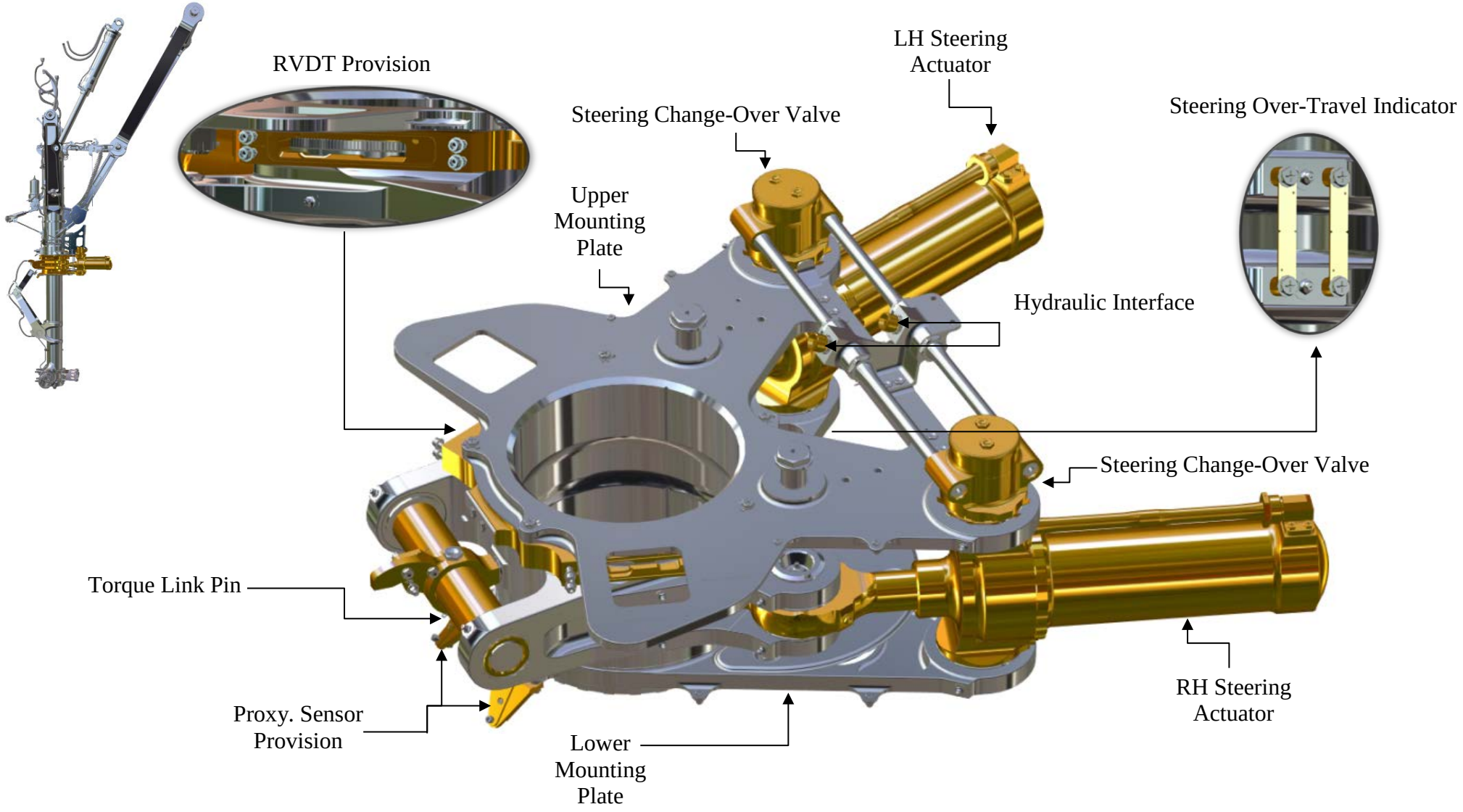
The shimmy damping system functions in the active and passive mode and is achieved with a combination of anti-cavitation, pressure relief and restrictor check valves within the steering control manifold.

The Upper steering plate is integral with the bearing tube. The Lower steering plate is aligned with the Upper steering plate using splines machined on the inside of the plate and the outside of the bearing tube.

The “push-pull” steering actuators are restrained via a trunnion mounting which is entrapped between the upper and lower steering plate lugs.

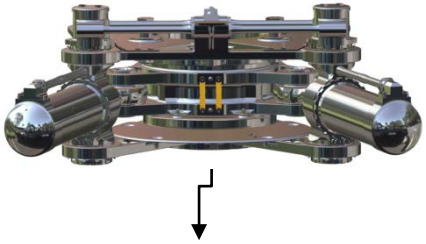
The whole steering motor assembly is retained on the Main Fitting by two bolts, nuts and cotter pins.

The steering cuff has integral shrink fit bushes with lubrication cavities that rotate against the bearing tube. This arrangement protects the lower Main Fitting surface isolating the area from dynamic motion. The motion of the steering cuff transmits rotation via the upper and lower torque links to the sliding tube/axle turning the wheels.

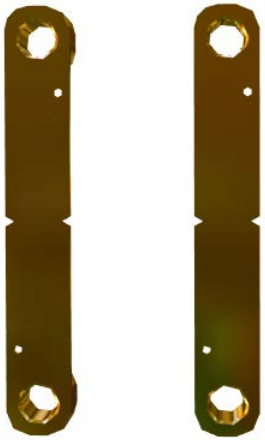

RVDT Provision
LH Steering Actuator
Steering Change-Over Valve
Steering Over-Travel Indicator
Upper Mounting Plate
Hydraulic Interface
Steering Change-Over Valve
Torque Link Pin
RH Steering Actuator
Proxy. Sensor Provision
Lower Mounting Plate

STEERING OVER-TRAVEL INDICATOR

Two brackets are attached to the steering cuff to give a clear and unambiguous indication if over-steering has occurred while the aircraft was unpowered. There are two identical brackets attached to give indication in which over-steering has occurred.



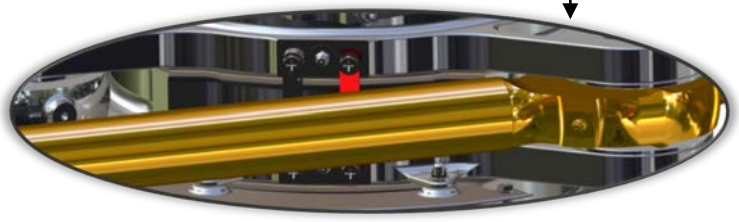
Steering Over-Travel Indicator



Brake Area

Front View Left Steering Max.

Steering Over-Travel Indicator will damage after an angel of more then 77, 20º. If the indicator is damage, please follow the AMM instructions.



Front View Right Steering Max.

STEERING CHANGE-OVER VALVE (SCOV)

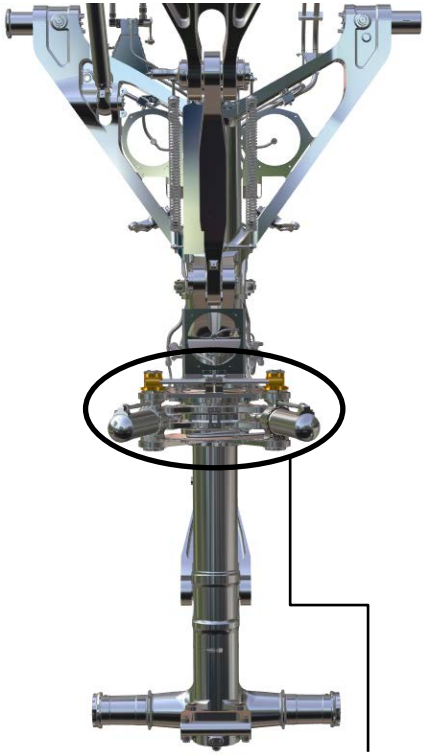
The SCOV connects the hydraulic supply and the return line to the steering actuator depending on the steering angle of the NLG.

There are two SCOV installed on the steering actuator carrier assembly of the NLG.

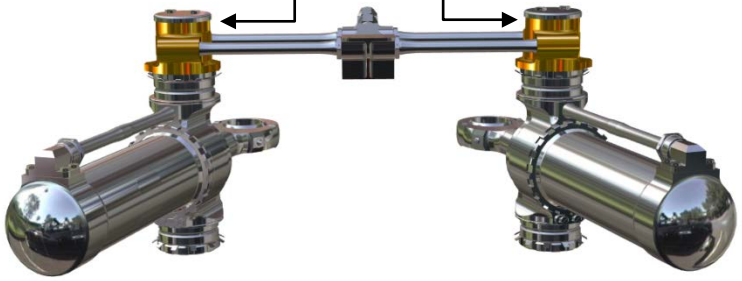
The SCOV has four ports for the hydraulic supply and the return line that follow:

- Port P1
- Port P2
- Port P3
- Port P4

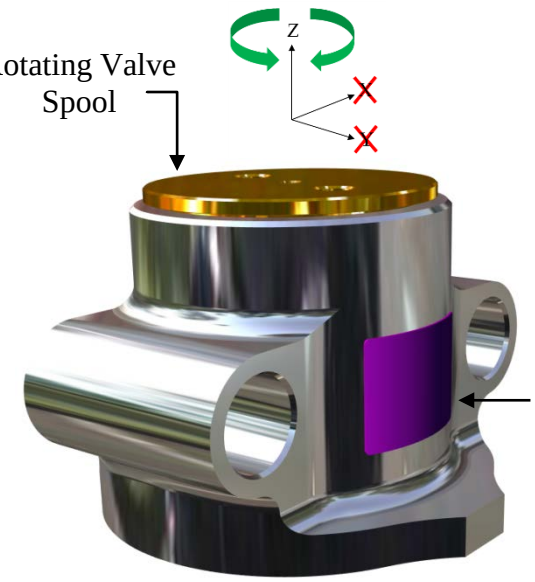
The SCOV has a shuttle valve in the supply and return line of the NLG steering actuators.



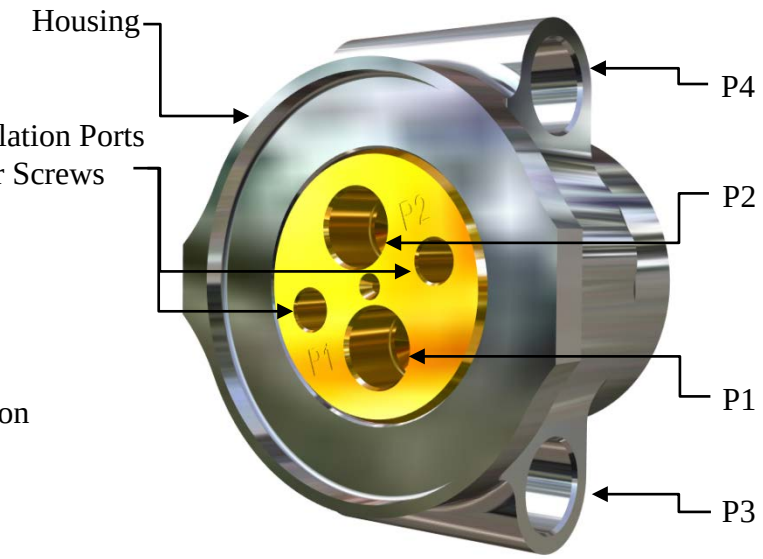
SCOV

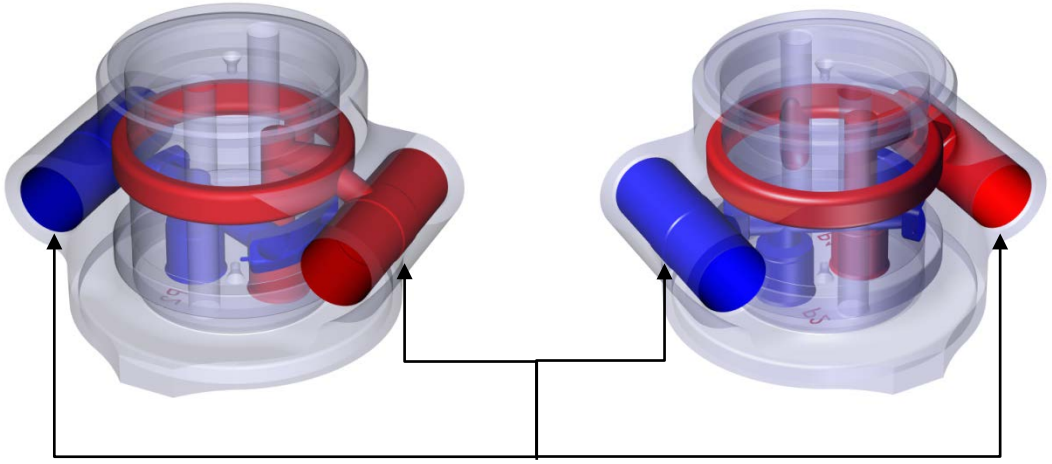


Side View



Lower Side





The hydraulic supply/return ports will change the hydraulic fluid direction due to the selected angle of steering mode.

STEERING CHANGE-OVER VALVE WORKING

The following figures show the powered steering sequence from 0° to 75°. The SCOV fulfils the sequences as described below.

NOTE: The SCOV shall provide unrestricted flow to return from 75° to 80°.

SCOV hydraulic supply lines are mounted on either side of the valve to eliminate the introduction of torque through the valve and provide the Anti-Rotation feature for the mechanism.

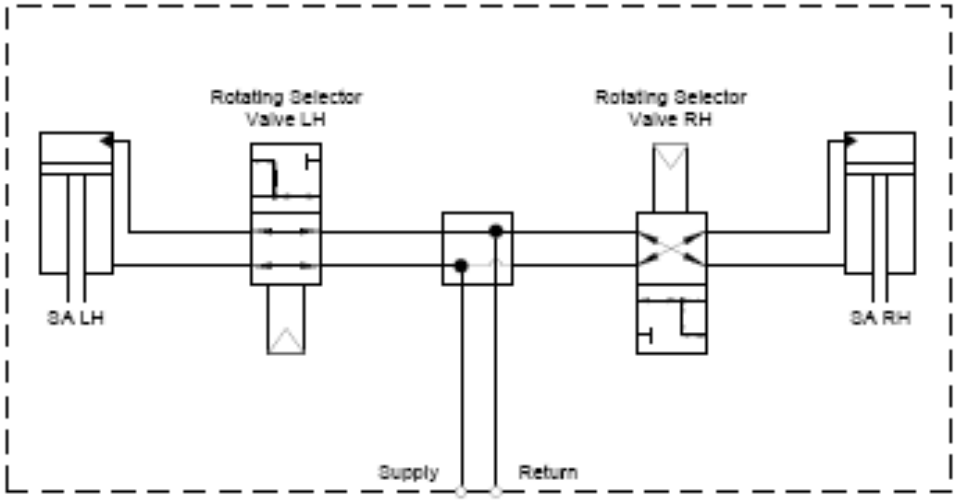
The steering system allows free to castor at up 20° per second steering rate when steering pressure is not applied for steering angle up to ±25°.

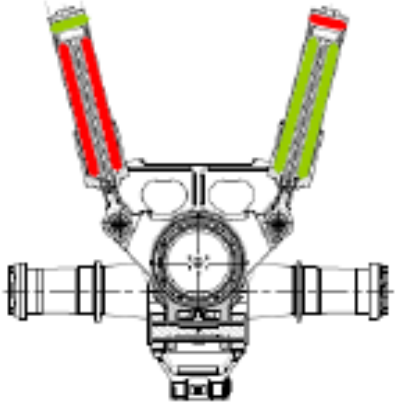
Extreme Operation temperature: The Steering Motor Assembly can operate with hydraulic fluid supplied in the temperature range -55°C to +110°C.

Survival Temperature: The steering Motor Assembly can withstand, without operation, hydraulic fluid supplied in the temperature range -55°C to +135°C.

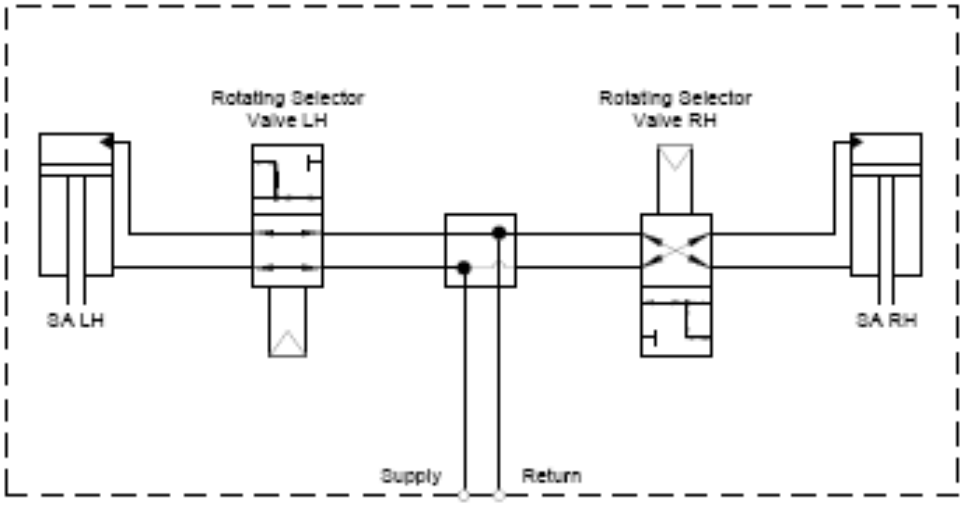
The Steering Motor Assembly is designed for a hydraulic supply pressure of 350 bars (5076 PSI) and for a maximum return pressure of 70 bars (1015PSI).

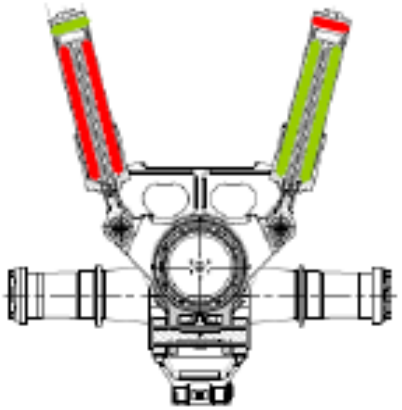
Scene 1: The Scene below shows the configuration of the SCOV at 0°.

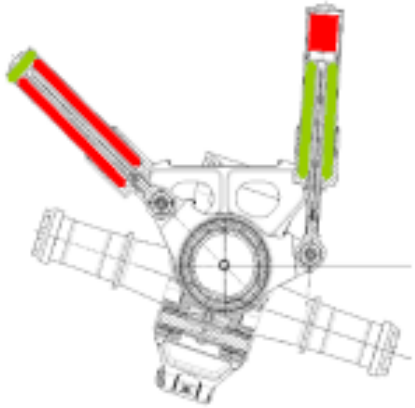




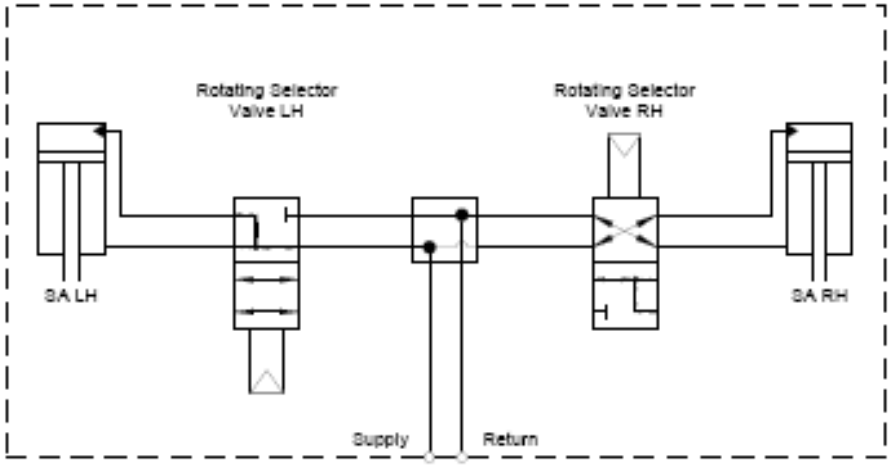
Scene 2: The Scene below shows the configuration of the SCOV between 0° and ~18°.

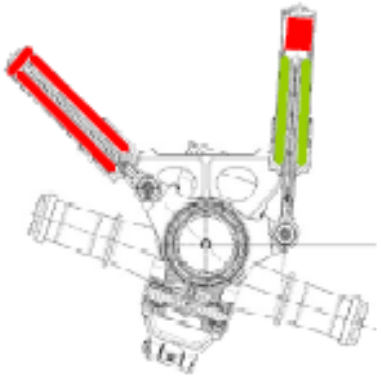




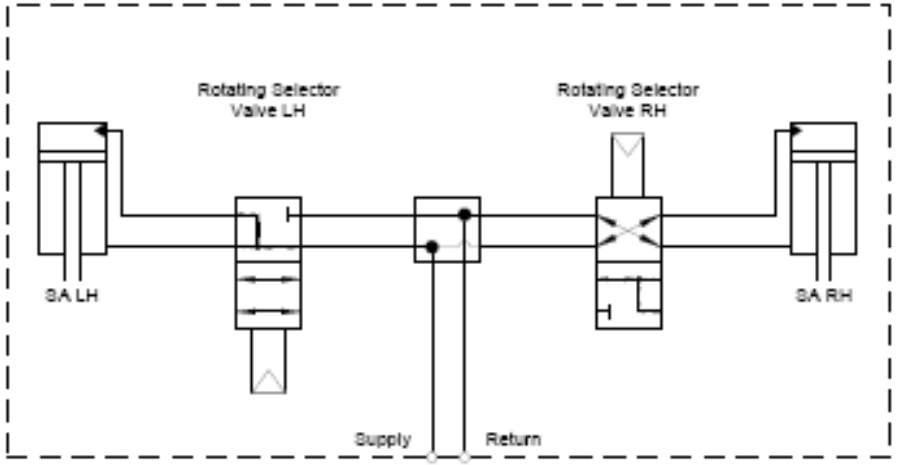


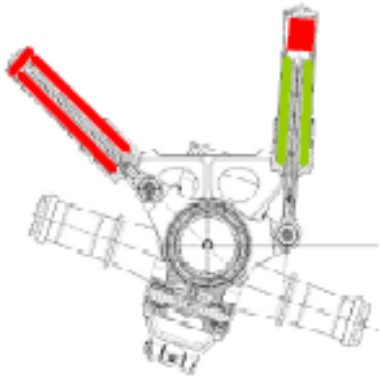
Scene 3: The Scene below shows the steering position between (~18° and ~20°), where the SCOV will turn mechanically from the configuration shown in Scene. 2 to the configuration shown in Scene. 3. This changeover position shall be “under lapped” (allow cross port flow) to prevent a hydraulic lock.

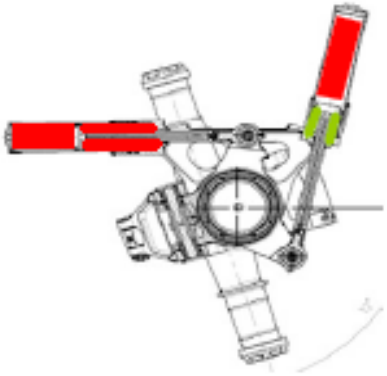




Scene 4: The Scene below shows the configuration of the SCOV between ~20° and 75°.







Nose Wheel Steering Hydraulic Control Block

EFFECTIVITY:

ALL

03 Dec 2014

NWSHCB

The Nose Wheel Steering Hydraulic Control Block (NWSHCB) is mounted on the aft side of the shock strut Main Fitting to protect it from FOD and bird strike etc, during landing and take-off and to allow the routing of hydraulic and electrical systems to make the best use of the Landing Gear Structure for protection.

Hydraulic supply and return lines to the steering change-over valves are routed through a transfer manifold mounted on the forward side of the shock strut on the steering motor upper mounting plate. This arrangement also provides a “keying” feature (anti-rotation) for the steering change-over valves housing.

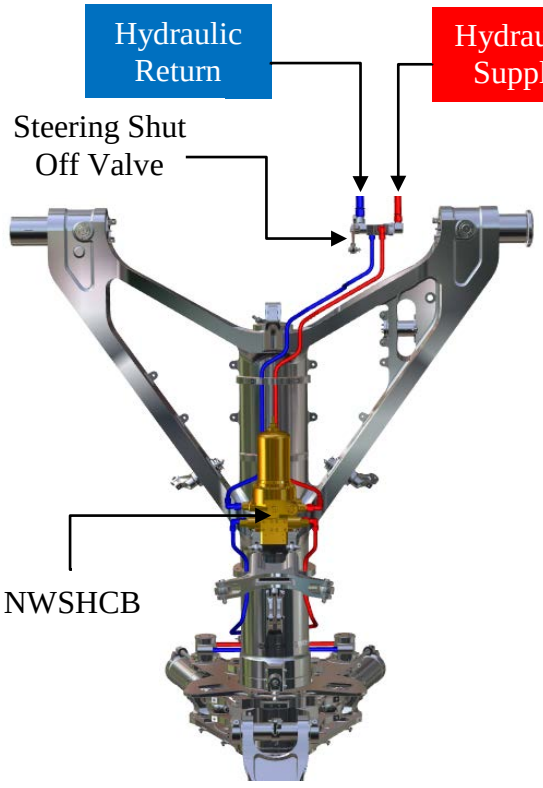
The hydraulic lines are mounted fore and aft between the transfer manifold and steering change-over valves to minimise the frontal area to particular risk.

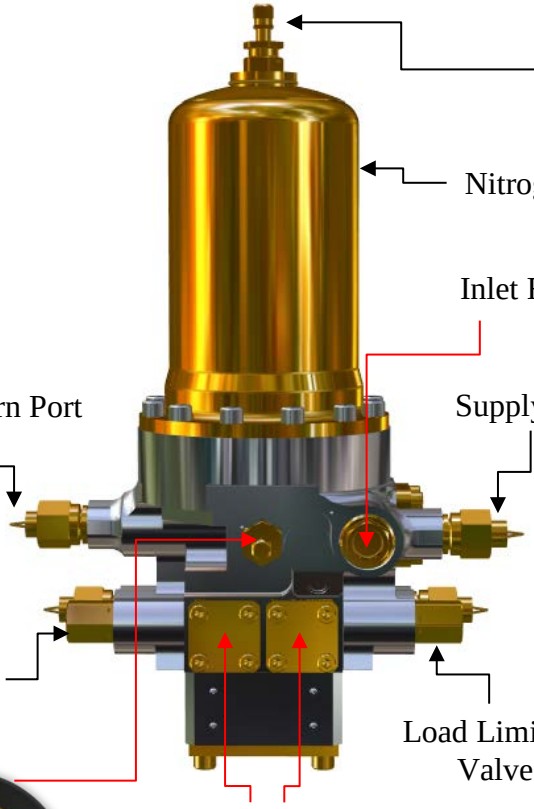
The pilot input commands from the cockpit hand-wheel are electrically transmitted through the controller to the NWSHCB where the steering servo valve directs hydraulic fluid to the relative steering actuator port via the steering change-over valves.

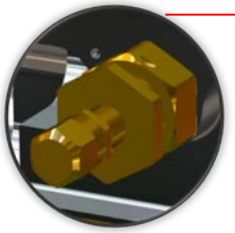
The NWSHCB has provision to permit active steering of the NLG, to provide anti shimmy damping in all modes and passive steering even if the hydraulic supply is not available.

Note: Before working on steering hydraulic system, please remove the hydraulic pressure (Open Hydraulic Pressure Relief Valve).

Back -View
(Visible Side on Shock Strut)



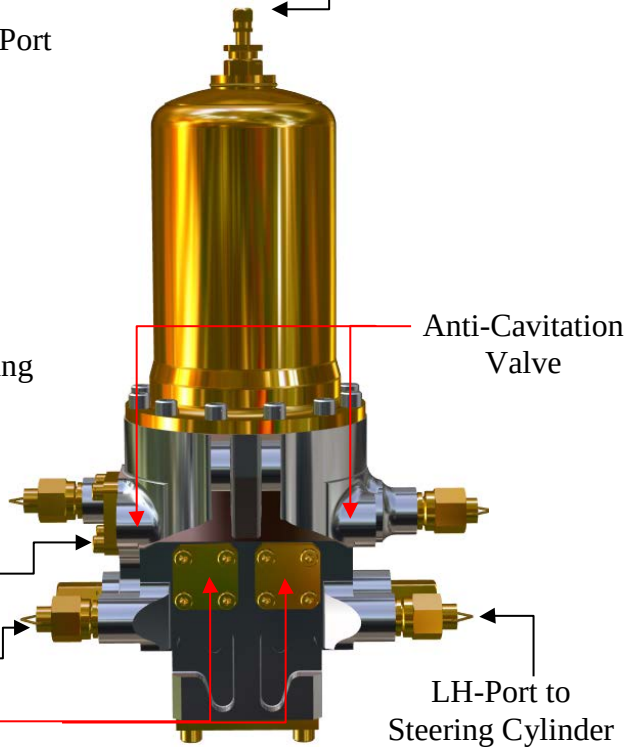


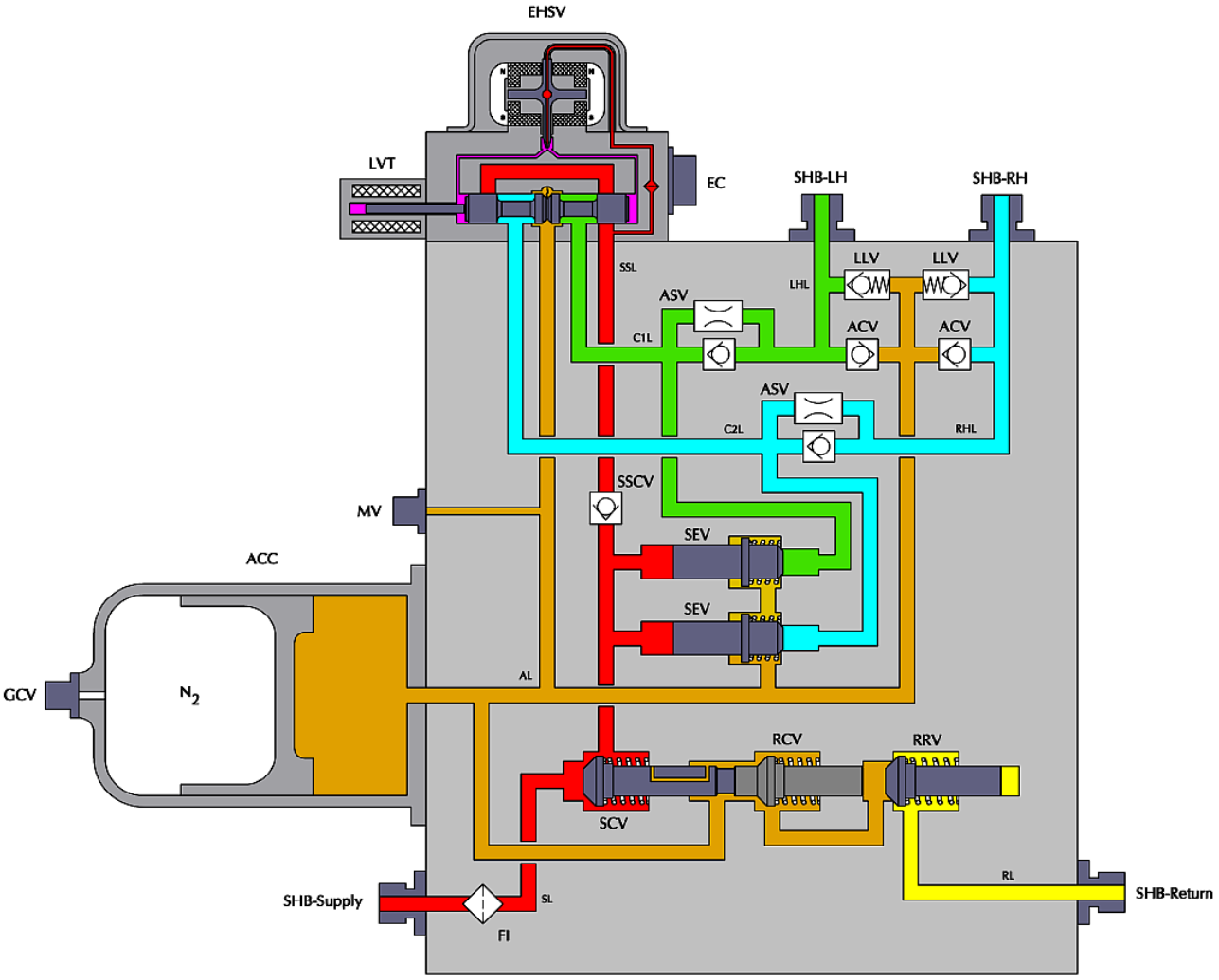


Hydraulic Pressure Relief Valve

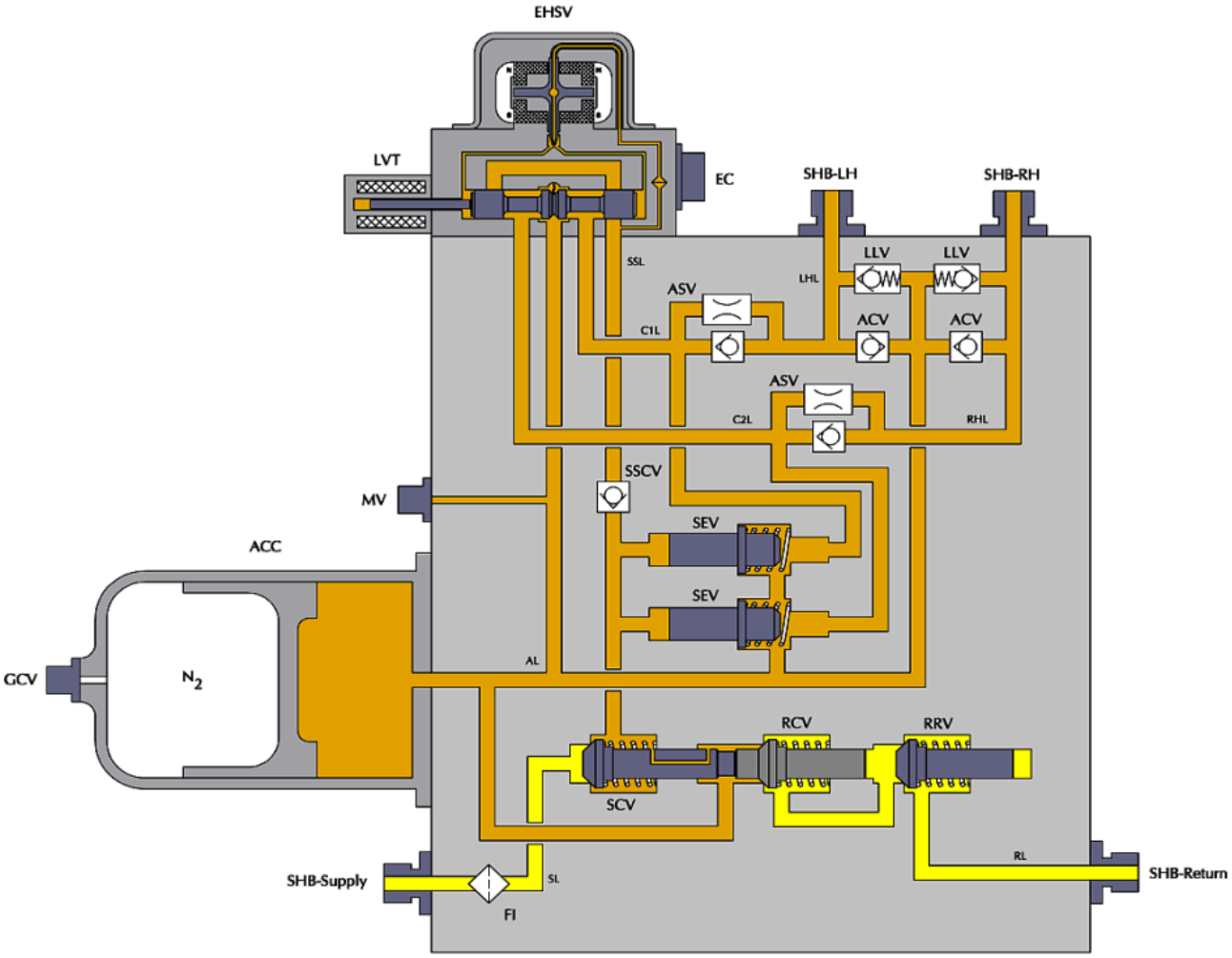
Front -View
(Installation Side on Shock Strut)

Nitrogen Charging Valve





Abbreviation	Full Name
ACC	Accumulator
ACV	Anti-Cavitation Valve
AL	Accumulator Line
ASV	Anti-Shimmy Valve
C1L:	C1-Line
C2L:	C2-Line
EHSV	Electro Hydraulic Servo Valve
EC	Electrical Connector
FI	Filter
GCV	Gas Charging Valve
LHL	Left Hand Line
LLV	Load Limiting Valve
MV	Maintenance Valve
SHB-Return	Steering Hydraulic Block Return Port
SHB-Supply	Steering Hydraulic Block Supply Port
SEV	Steering Enable Valve
SCV	Supply Check Valve
SL	Supply Line
SSCV	Servo Supply Check Valve
SSL	Servo Supply Line
RCV	Return Check Valve
RRV	Return Relief Valve
RL	Return Line
RHL	Right Hand Line



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EC	Electrical Connector
FI	Filter
GCV	Gas Charging Valve
LHL	Left Hand Line
LLV	Load Limiting Valve
MV	Maintenance Valve
SHB-Return	Steering Hydraulic Block Return Port
SHB-Supply	Steering Hydraulic Block Supply Port
SEV	Steering Enable Valve
SCV	Supply Check Valve
SL	Supply Line
SSCV	Servo Supply Check Valve
SSL	Servo Supply Line
RCV	Return Check Valve
RRV	Return Relief Valve
RL	Return Line
RHL	Right Hand Line

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Steering Actuator

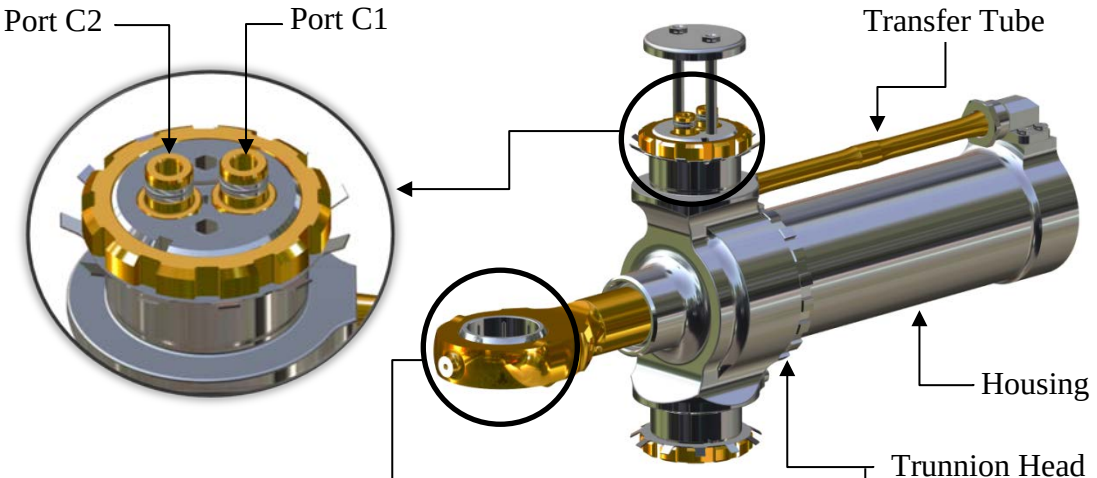
EFFECTIVITY:

ALL

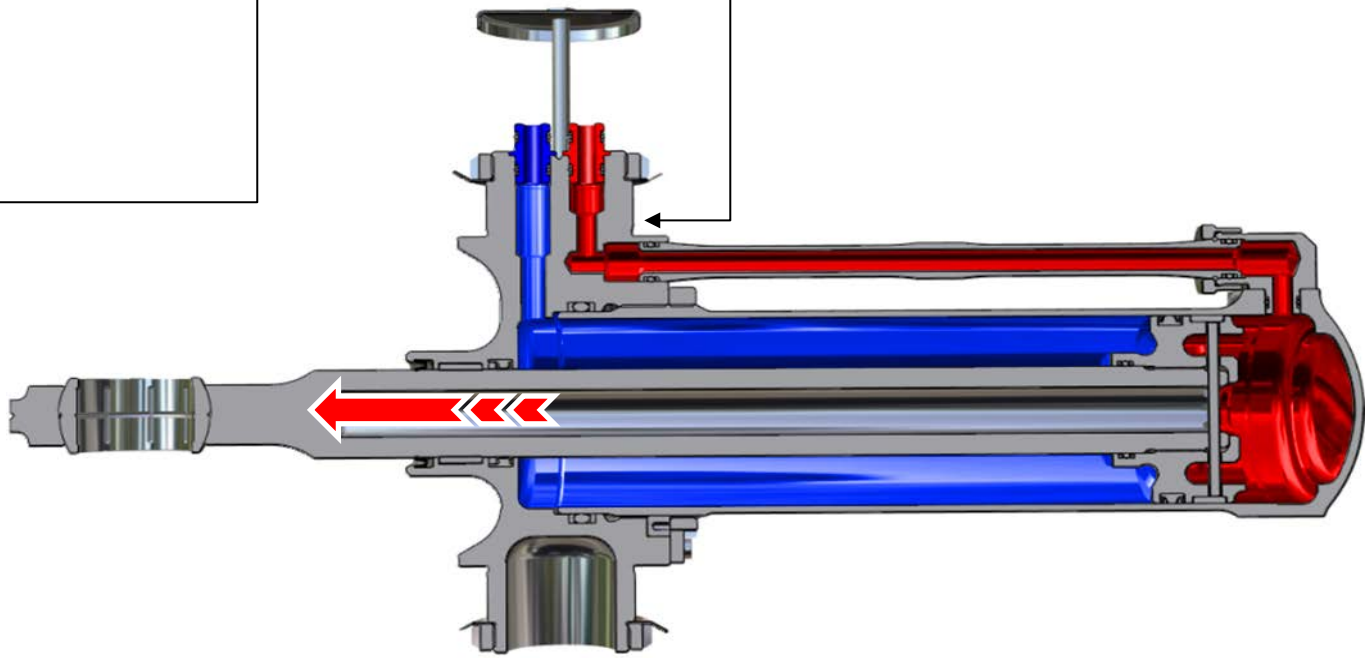
03 Dec 2014

STEERING ACTUATOR ASSEMBLY

The actuator housing consists of 2 pieces. A cylinder and a trunnion head. Also the design of the actuator rod has got an integral eye-end with a separate piston for assembly.



Possible Movement of the Swivel Bearing



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Steering Shut Off Valve

EFFECTIVITY:

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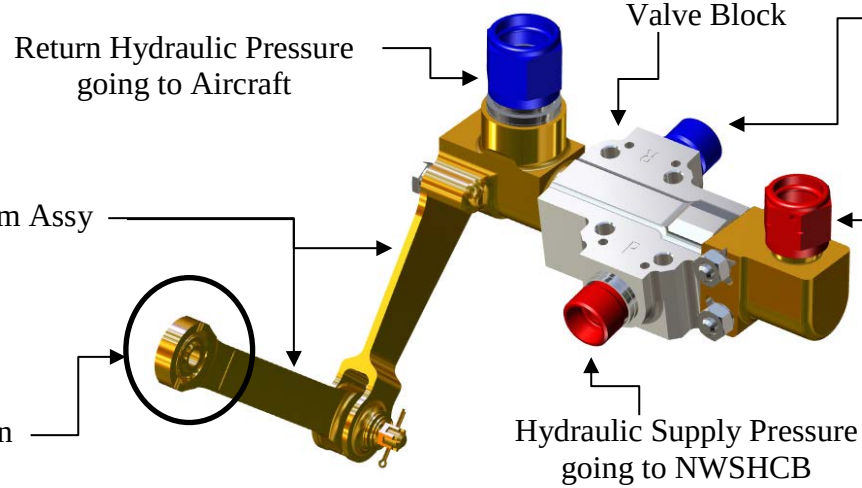
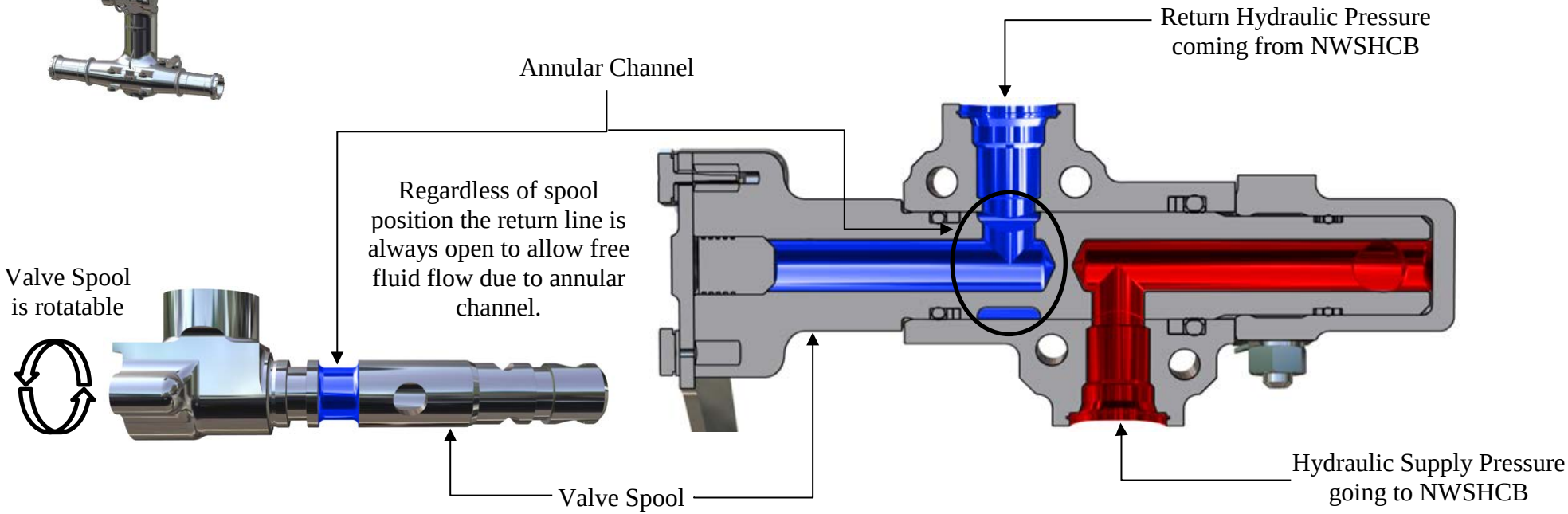
03 Dec 2014

STEERING SHUT OFF VALVE (SSOV)

The Steering Shut off Valve is situated at the top of the Main Fitting and mounted to the Upper “Y” of the Main Fitting. The housing of the valve is rigidly mounted to the Main Fitting and the spool is connected to the aircraft bulkhead via a linkage. The rotation axis of the spool lies on the NLG retraction rotation axis and the spool isolates the hydraulic supply and connects all cavities to return as the NLG is retracted.

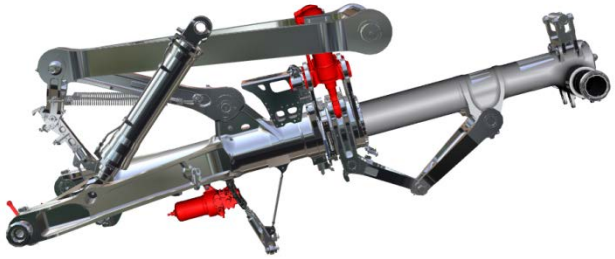

Return Hydraulic Pressure going to Aircraft
Valve Block
Return Hydraulic Pressure coming from NWSHCB
Lever Arm Assy
Hydraulic Pressure coming from Aircraft
Installation Point on Aircraft Structure
Hydraulic Supply Pressure going to NWSHCB


Return Hydraulic Pressure coming from NWSHCB
Annular Channel
Regardless of spool position the return line is always open to allow free fluid flow due to annular channel.
Valve Spool is rotatable
Valve Spool
Hydraulic Supply Pressure going to NWSHCB

SSOV WORKING

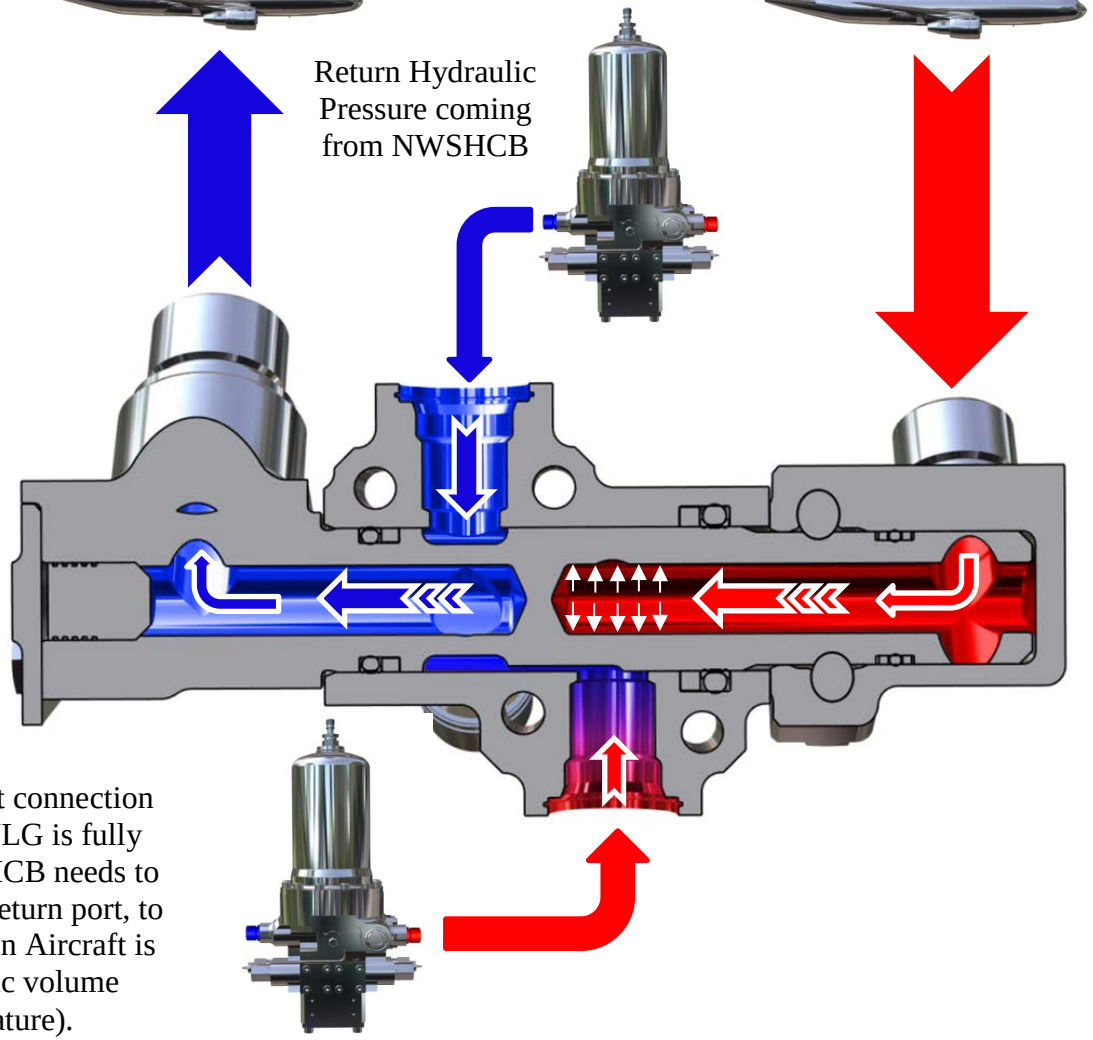
NLG Retracted:

If the NLG is fully retracted, the SSOV cut of the hydraulic pressure from the aircraft to the NWSHCB. In that position, no hydraulic fluid can flow to the steering actuators. This function avoids unintentionally movement of the steering system.



SSOV Closed Position

SSOV close hydraulic supply port therefore steering system is not pressurized.

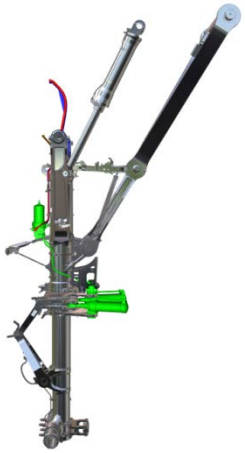


Hydraulic supply pressure port connection coming from NWSHCB. If NLG is fully retracted, the port from NWSHCB needs to be connected internally to the return port, to avoid mechanical damage when Aircraft is in flight condition (hydraulic volume changing due to temperature).

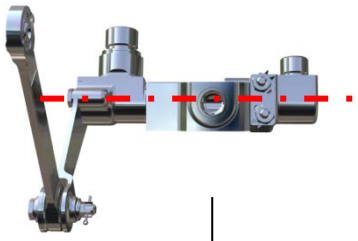
SSOV WORKING

NLG Extended:

If the NLG is fully extended, the SSOV open the hydraulic pressure from the aircraft to the NWSHCB. In that position, hydraulic fluid can flow to the steering actuators. The steering actuators can now rotate the sliding tube to left or right side.



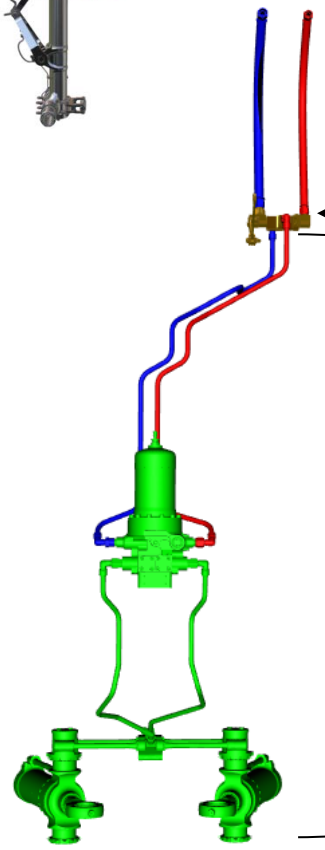
Cutting Line

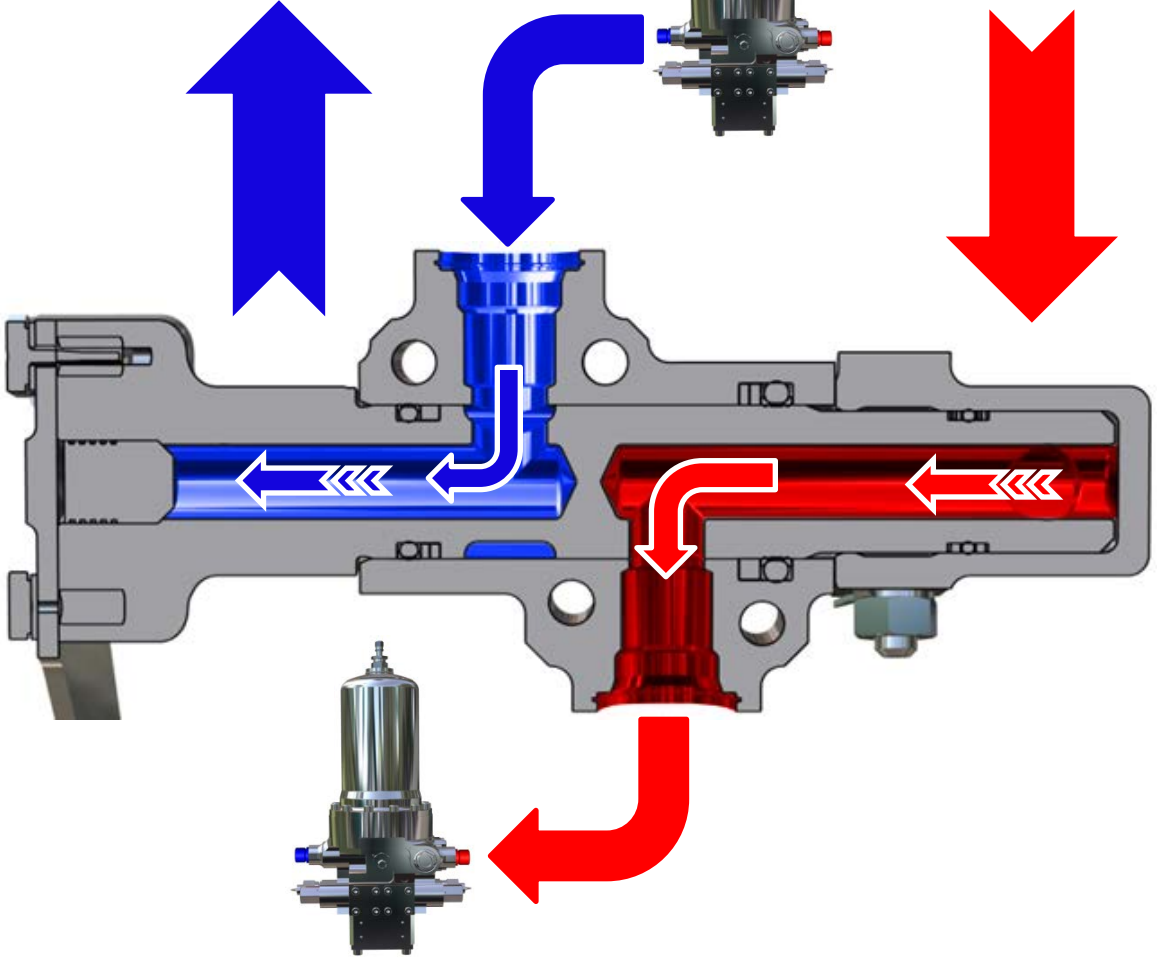


Return Hydraulic Pressure going to Aircraft

Hydraulic Pressure coming from Aircraft

SSOV Open Position





SSOV open hydraulic supply port therefore steering system is hydraulically pressurized.

EFFECTIVITY:

ALL

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