



Bulletin HY30-5504-M1/UK

Service Manual Series F12

Effective: September, 2019
Supersedes: April, 2011



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Conversion factors

1 kg	= 2.2046 lb
1 N	= 0.22481 lbf
1 bar	= 14.504 psi
1 l	= 0.21997 UK gallon
1 l	= 0.26417 US gallon
1 cm ³	= 0.061024 in ³
1 m	= 3.2808 feet
1 mm	= 0.03937 in
9/5 °C + 32	= °F

**WARNING**

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General information

F12 is bent axis, fixed displacement heavy-duty motor/pump series. They can be used in numerous applications in both open and closed loop circuits.

Series F12 conforms to current ISO and SAE mounting flange and shaft end configurations. A very compact cartridge version is also available.

Frame sizes: F12-30, -40, -60, -80, -90, -110, -125, -150, -250.

Thanks to the unique spherical piston design, F12 motors can be used at unusually high shaft speeds. Operating pressures to 480 bar provides for the high output power capability.

The 40° angle between shaft and cylinder barrel allows for a very compact, lightweight motor/pump.

The laminated piston ring offers important advantages such as low internal leakage and thermal shock resistance.

The pump version has highly engineered valve plates for increased selfpriming speed and low noise, available with left and right hand rotation.

The F12 motors produce very high torque at start-up as well as at low speeds.

Our unique timing gear design synchronizes shaft and cylinder barrel, making the F12 very tolerant to high 'G' forces and torsional vibrations.

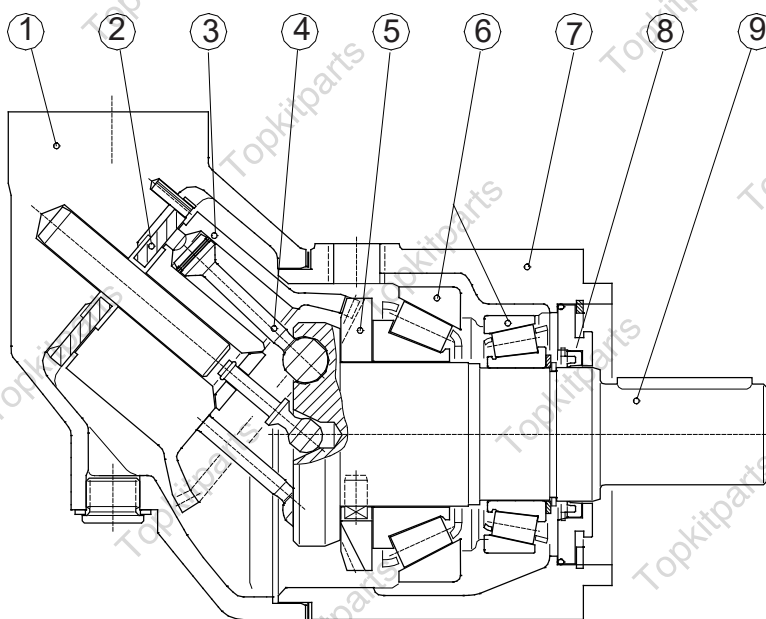
Heavy duty roller bearings permit substantial external axial and radial shaft loads.

The F12's have a simple and straightforward design with very few moving parts, making them very reliable motors/pumps.

The unique piston locking, timing gear and bearing set-up as well as the limited number of parts add up to a very robust design with long service life and, above all, proven reliability.

F12 cross section

1. Barrel housing
2. Valve plate
3. Cylinder barrel
4. Piston with piston ring
5. Timing gear
6. Tapered roller bearing
7. Bearing housing
8. Shaft seal
9. Output/input shaft



Frame size	F12-030	F12-040	F12-060	F12-080	F12-090	F12-110	F12-125	F12-150	F12-250
Displacement (cm ³ /rev)	30.0	40.0	59.8	80.4	93.0	110.1	125.0	150.0	242.0
Operating Pressure									
max intermittent ¹⁾ (bar)	480	480	480	480	420	480	480	420	420
max continuous (bar)	420	420	420	420	350	420	420	350	350
Motor operating speed									
max intermittent ¹⁾ (rpm)	7 300	6 700	5 800	5 300	5 000	4 800	4 600	3500	3000
max continuous (rpm)	6 700	6 100	5 300	4 800	4 600	4 400	4 200	3200	2700
min continuous (rpm)	50	50	50	50	50	50	50	50	50
Max pump selfpriming speed²⁾									
L or R function; max (rpm)	3150	2870	2 500	2 300	2 250	2 200	2 100	1700	1500
Motor input flow									
max intermittent ¹⁾ (l/min)	219	256	347	426	465	528	575	525	726
max continuous (l/min)	201	244	317	386	428	484	525	480	653
Main circuit temp.³⁾									
max (°C)	80	80	80	80	80	80	80	80	80
min (°C)	-40	-40	-40	-40	-40	-40	-40	-40	-40
Mass moment of inertia									
(x10 ⁻³) (kg m ²)	1.7	2.9	5.0	8.4	8.4	11.2	11.2	40.0	46.0
Weight									
(kg)	12.0	16.5	21.0	26.0	26.0	36.0	36.0	70.0	77.0

1) Intermittent: max 6 seconds in any one minute.

2) Selfpriming speed valid at sea level.

3) See also below, operating temperature.

Operating temperature

The following temperatures should not be exceeded
(N shaft seals): Drain fluid: 90 °C.

FPM shaft seals (type V) can be used to
115 °C drain fluid temperature.

NOTE: The temperature should be measured at
the utilized drain port.

Continuous operation may require case flushing in
order to meet the viscosity and temperature limitations.

For further information we refer to:
Catalogue HY30-8249/UK

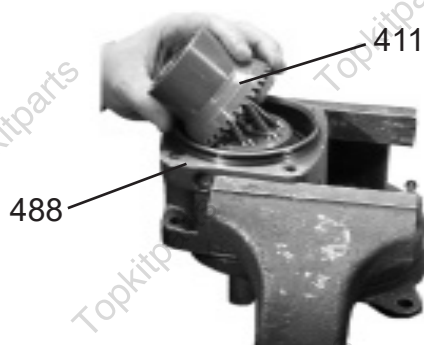
Disassemble



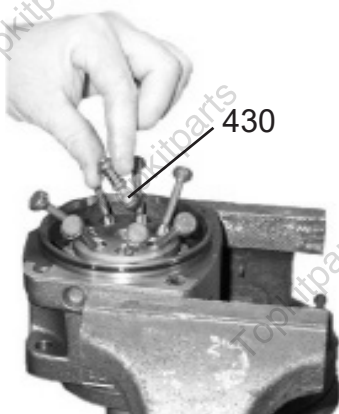
Fasten the unit in a vice. Loosen the 4 bolts (item 491).



Disassemble the barrel housing (item 110). Make sure that the valve plate doesn't fall out when lifting the barrel housing off.



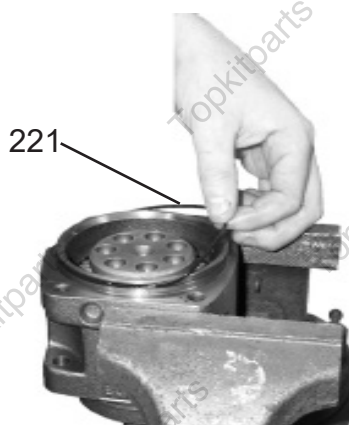
Remove the cylinder barrel (item 411). Take the shim (item 488) away.



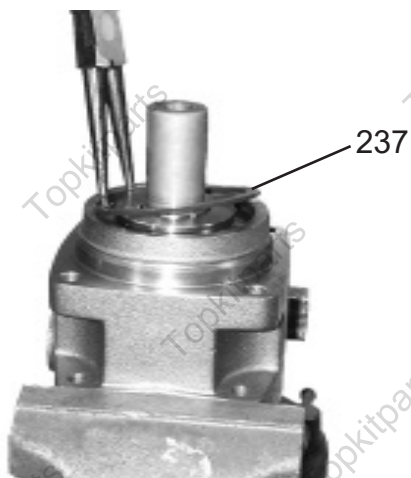
Remove the barrel support (item 430).



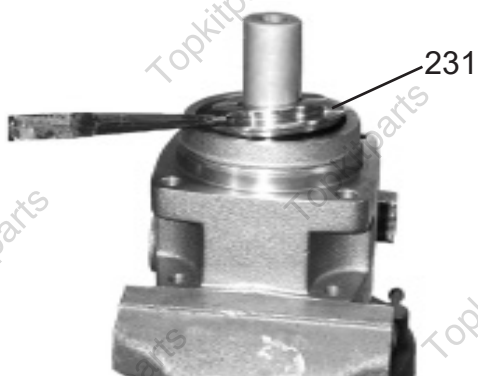
Disassemble the pistons (item 440).



Remove the O-ring (item 221).



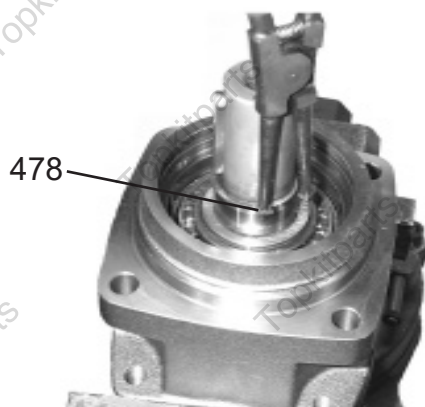
Disassemble the retaining ring (item 237).



Remove the seal carrier (item 231).



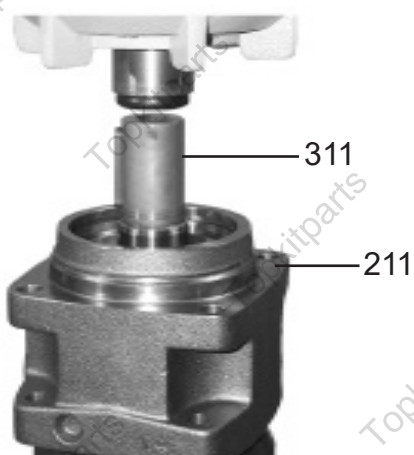
Remove the O-ring (item 225).



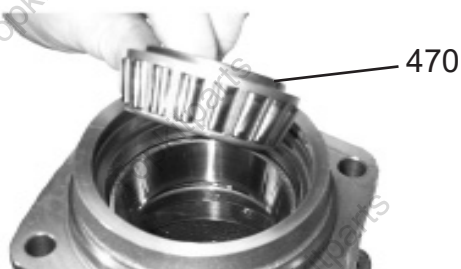
Disassemble the retaining ring (item 478).



Remove the spacer washer (item 476).



Place the bearing housing (item 211) on a tube. Press out the shaft (item 311) by pressing on the shaft end.



Remove the small tapered roller bearing (item 470).



Tap the small bearing ring off with a mandrel.



Tap the large bearing ring off with a mandrel.



Place the ring gear (item 452) on a tube.
Press the shaft (item 311) out with a press.

Assemble F12-30/40/60/80/90/110 and 125

Press down the tapered roller bearing (item 460) and the ring gear (item 452) on the shaft with a press. Use a tube (see page 16).

460

452



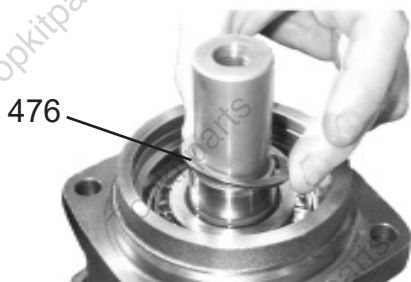
Press down the bearing ring (item 460) in the bearing housing (item 211) with a press. Use a tube to match the outer diameter off the bearing ring.

211

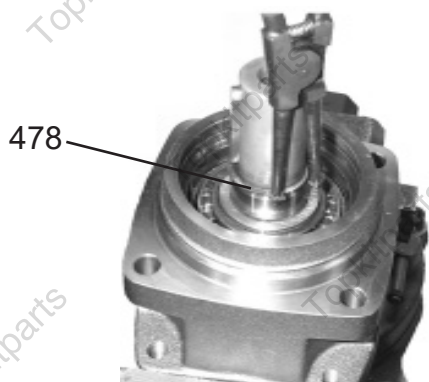


Press down the bearing ring (item 470) in the bearing housing (item 211) with a press. Use a tube to match the outer diameter off the bearing ring.

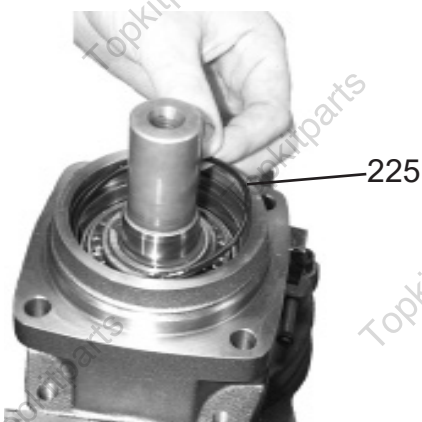
211



Press down the Bearing (item 470) with a press until correct preload is achieved. Install the spacer washer (item 476).



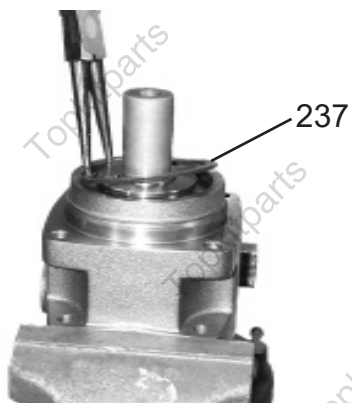
Install the retaining ring (item 478).



Install the O-ring (item 225).



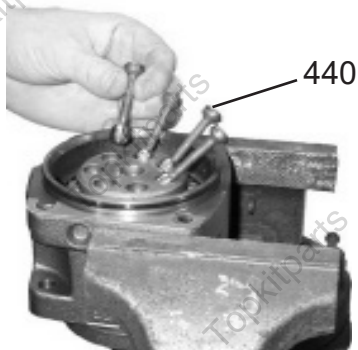
Install the seal carrier (item 231).



Install the retaining ring (item 237).



Install the O-ring (item 221).



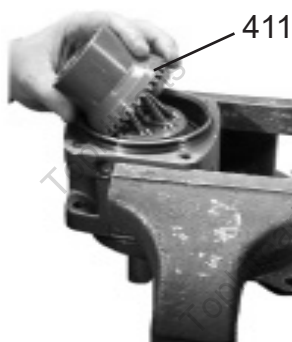
Install the pistons (item 440).



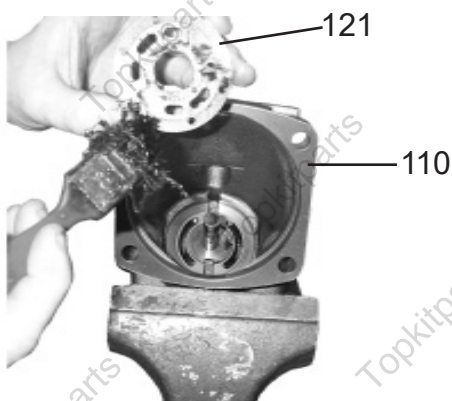
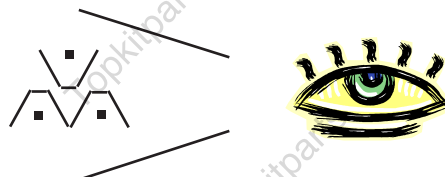
Install the barrel support (item 430).



Install the shim (item 488).

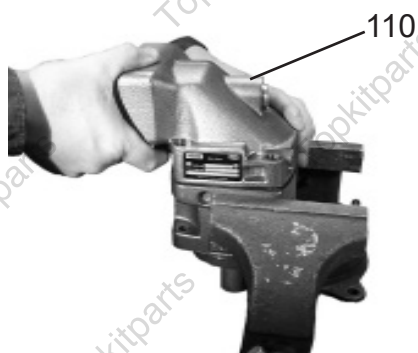


Install the cylinder barrel (item 411). Ensure correct timing. (marking - punch mark)



Put some grease on the valve plate (item 121) and install it into the barrel housing (item 110).

Make sure you have installed the valve plate correct (see page 18).



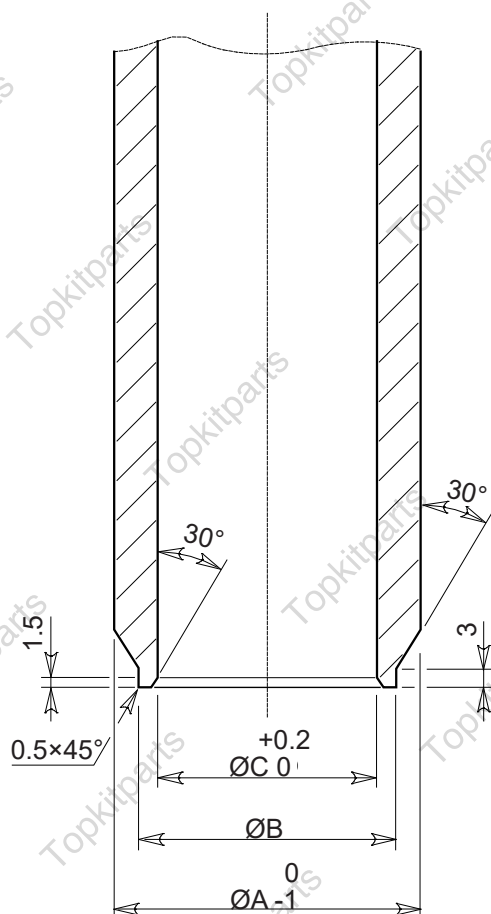
Install the barrel housing (item 110). Fasten two bolts and secure that the backlash is between 0,1 - 0,3 mm. Check it with a feeler gauge in the drain port. At the same time double check the timing, (marking - punch mark).



Fasten the 4 bolts (item 491) to specified torque.

F12-030	65 ± 10 Nm
F12-040	65 ± 10 Nm
F12-060	65 ± 10 Nm
F12-080	115 ± 10 Nm
F12-090	115 ± 10 Nm
F12-110	115 ± 10 Nm
F12-125	115 ± 10 Nm
F12-150	220 ± 35 Nm
F12-250	220 ± 35 Nm

Tools to be used to facilitate the installation of the tapered roller bearings.

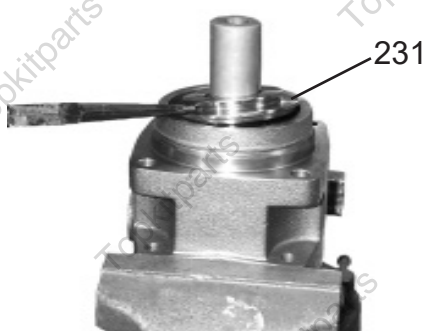


Type	ØA	ØB	ØC
F12-030	60	49	42
F12-040	65	58	52
F12-060	73	64	57
F12-080/090	74	70	62
F12-110/125	82	75	67
F12-150/250	97	-	82

Change of shaft seal



Remove the retaining ring (item 237).



Remove the seal carrier (item 231).



Tap the shaft seal out with hammer and mandrel.



Tap the new shaft seal back with a tube and a hammer.
The outside diameter on the tube is 65mm.

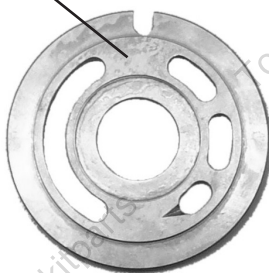
Valve plates F12

Following valve plates can be fitted in F12.

**M**

M = Bi-directional, motor operation

Against cylinder barrel

**L**

L = L.H. rotation, pump operation

**R**

R = R.H. rotation, pump operation

Against cylinder barrel

**G**

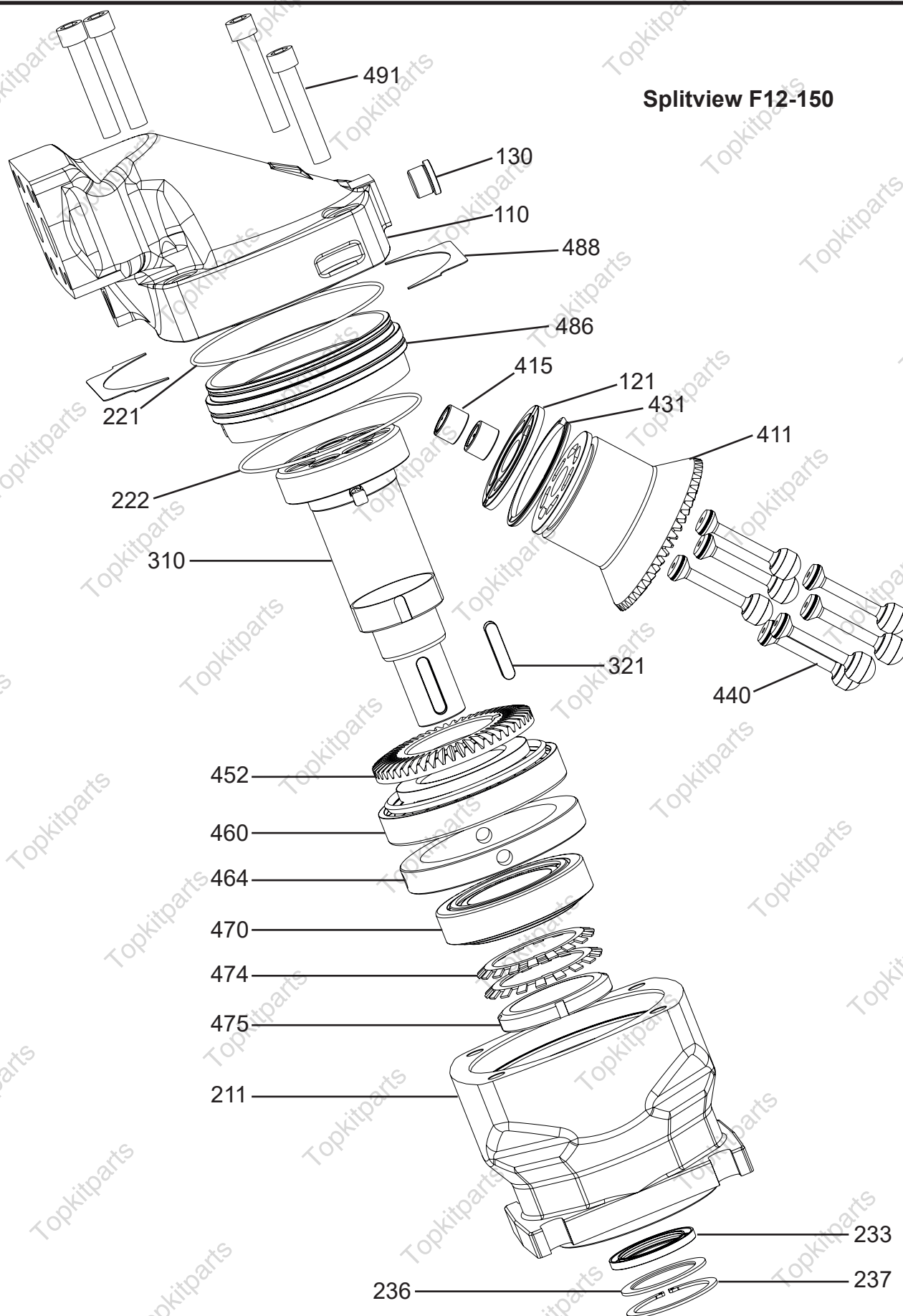
G = L.H. rotation, internal drain, motor operation

**X**

X = Bi-directional, pump operation, high self priming speed

Against cylinder barrel

Splitview F12-150



Assembly F12-150

1. Press down the tapered roller bearing (item 460) and the ring gear (item 452) on the shaft with a press. Use a tube (see page 16).



3. Assemble the lock washers (item 474) and the ring gear (item 452) and the round nut (item 475). Tap in the lock washers to lock the round nut.



2. Carefully press down the tapered roller bearing (item 470) until correct preload of the bearing package is achieved. Use a tube (see page 16).



4. Assemble the pistons (item 440). Lubricate the ball sockets before assembling.

Assembly F12-150

5. Assemble the valve plate (item 121) in the barrel housing (item 110). Make sure you have installed the valve plate correct (see page 18).



7. Assemble the shims (item 488) and the guide spacer (item 486). Locate one opening in the guide spacer against the drain connection on the barrel housing.



6. Tap down the cylinder barrel (item 411) with barrel retaining ring (item 431) and needle bearings (item 415). Use a plastic collar.



8. Assemble the bearing package with pistons.

Assembly F12-150

9. Make sure the timing is correct.



11. Assemble the retaining ring (item 237). Lubricate the shaft seal before assembling the housing.

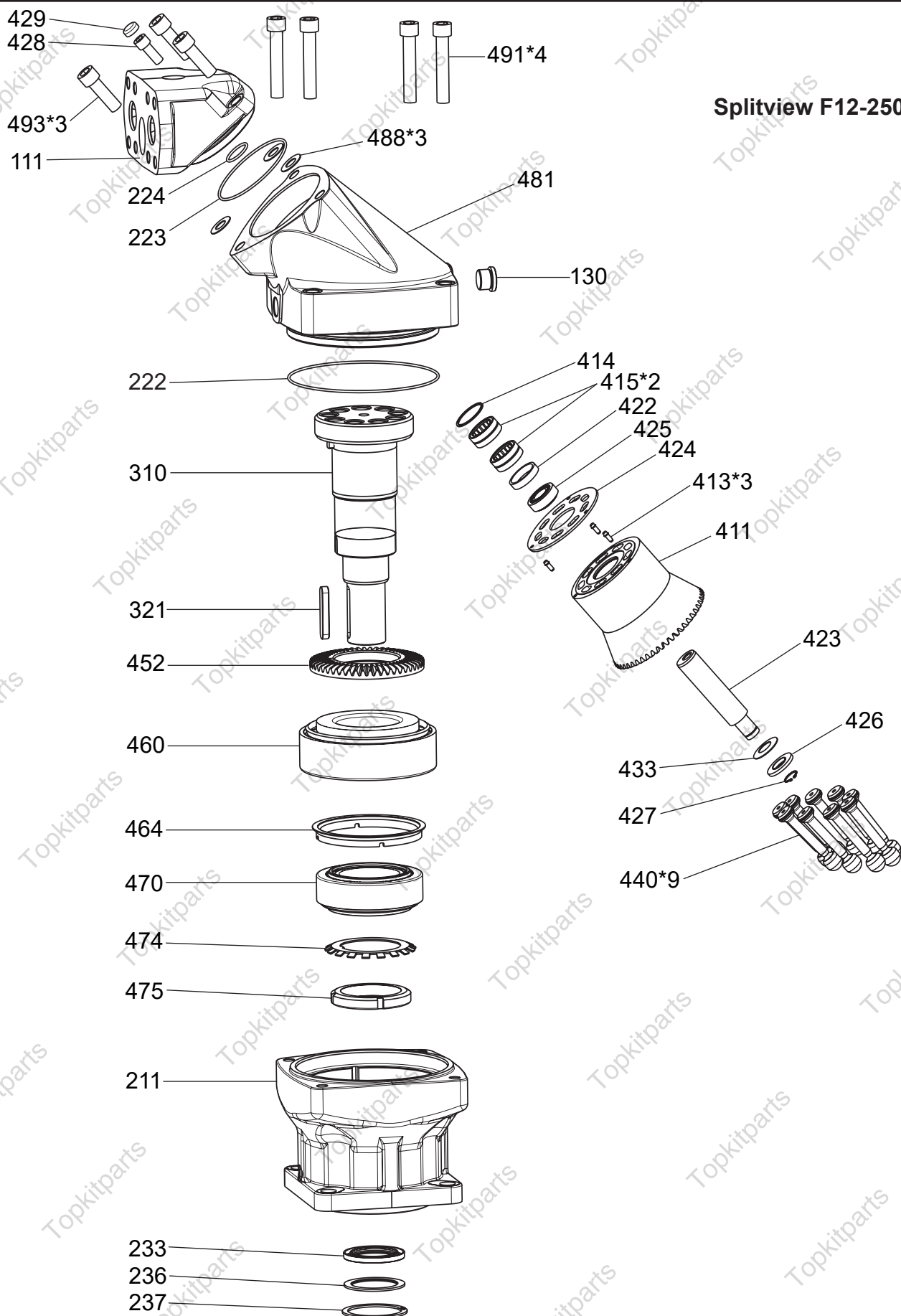


10. Assemble the shaft seal (item 233) and the support ring (item 236). Locate the chamfer on the support ring downwards. Tap it down with a plastic collar.



12. Assemble the bearing housing (item 211), tap it down with a plastic hammer. Torque the screws to 220 ± 35 Nm.

Splitview F12-250



Assembly F12-250

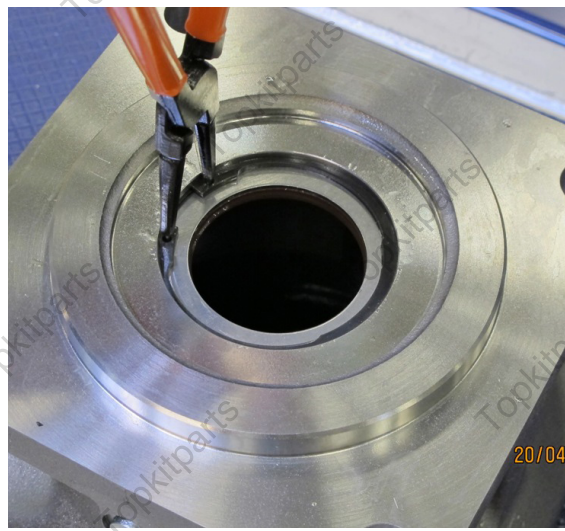
1. Press down the tapered roller bearing (item 460) and the ring gear (item 452) on the shaft with a press. Use a tube (see page 16).



3. Assemble the lock washers (item 474) and the round nut (item 475). Tap in the lock washers to lock the round nut.



2. Carefully press down the tapered roller bearing (item 470) until correct preload of the bearing package is achieved. Use a tube (see page 16).



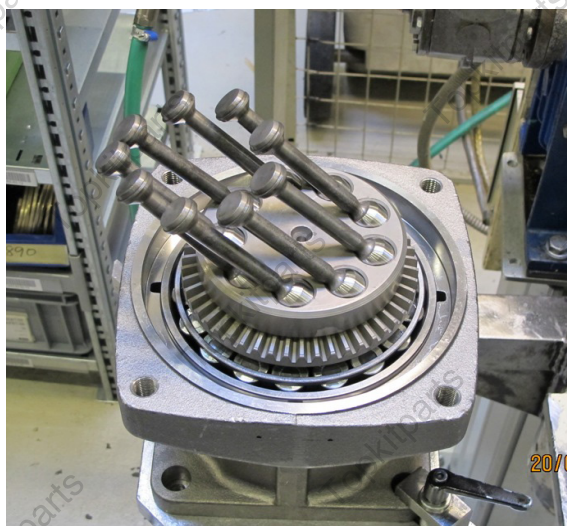
4. Assemble the shaft seal (item 233) and the support ring (item 236). Locate the chamfer on the support ring downwards. Tap it down with a plastic collar. Assemble the retaining ring (item 237). Lubricate the shaft seal before assembling the housing.

Assembly F12-250

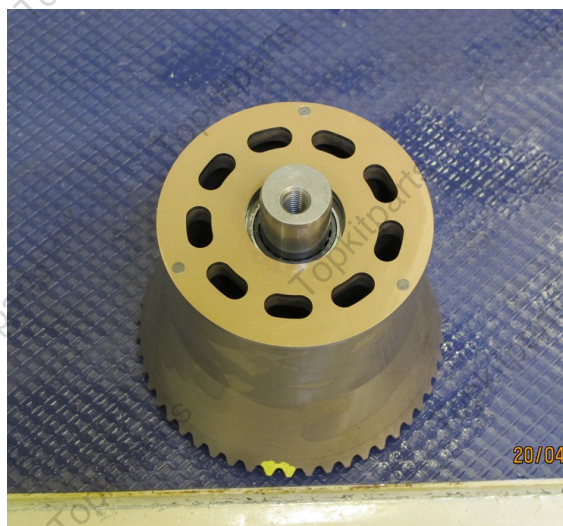
5. Tap down the bearing package into the bearing housing (item 211) by using a plastic collar and a plastic hammer.



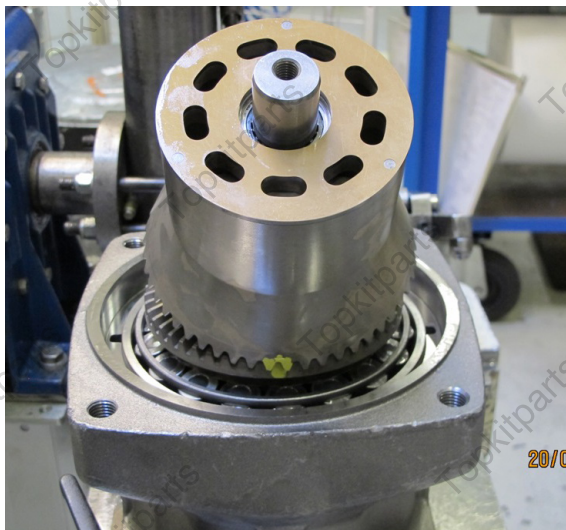
7. Assemble the tap roller bearing (item 425), the disc spring (item 433), the spacer washer (item 426) and the retaining ring (item 427).



6. Assemble the pistons (item 440). Lubricate the ball sockets before assembling.



8. Press down the bearing ring (item 425), the spacer sleeve (item 422), the needle bearings (item 415) and the retaining ring (item 414). Locate the needle bearings against the retaining ring. Assemble the spring pins (item 413) and the sliding plate (item 424).

Assembly F12-250

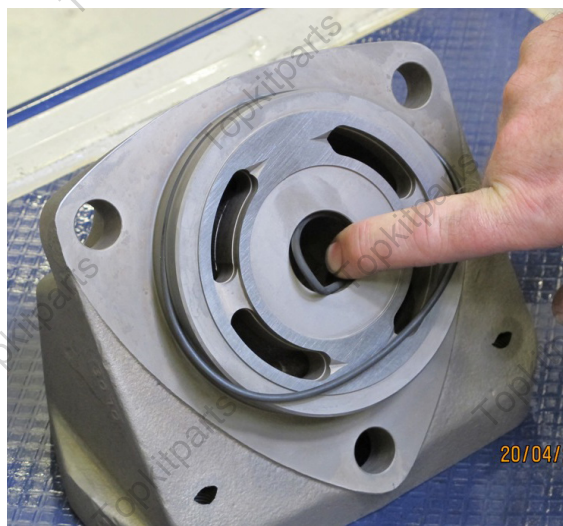
9. Assemble the cylinder barrel (item 411) on the pistons (item 440). Make sure the timing is correct.



11. Assemble the barrel housing. Make sure the cylinder barrel is in correct position by holding the barrel spindle (item 423). Tap the housing down with a plastic hammer.



10. Assemble the O-ring (item 222) on the barrel housing (item 481). Lubricate the O-ring.



12. Assemble the O-rings (item 223 and 224) on the end cap (item 111). Lubricate the O-rings.

Assembly F12-250

13. Place the end cap on to the barrel housing until the O-ring is entered.



15. Knock down the end cap with a plastic hammer and fit shims (item 488) and hexagon screws (item 493). Torque the screws to 330 ± 10 Nm.



14. Fit a long screw (M12) to the barrel spindle and pull the barrel spindle up with a universal pliers.



16. Install the cap screw (item 428) that secures the barrel spindle.

Assembly F12-250

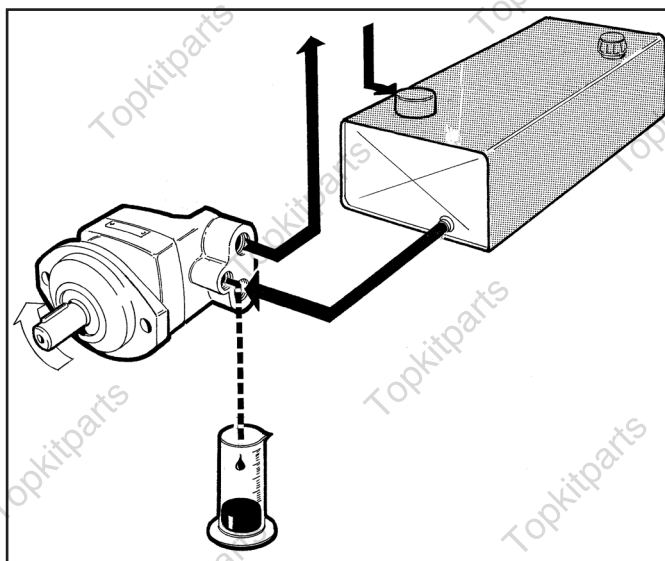
17. Torque the cap screw to 40 - 45 Nm and back off 1/3 off a turn to obtain correct axial play.



18. Hit the cap screw one time to obtain back-lash. Make sure the back-lash is correct.

The general condition of the unit can be established by checking the drain flow. Remove the drain line and keep the drain port above a suitable container. Run the unit at 500 rpm and pressurise the system to 200 bar (3000 psi)

Measure the drain flow for one minute; if it exceeds the maximum figures shown below, the unit is worn or damaged internally and should be replaced or repaired. Also, check for leakage at the shaft seal and between the bearing and barrel housings.



Series	Normal (gpm, US)	Normal (l/min)	Max (gpm, US)	Max (l/min)
F12-030	0.12	0.5	0.24	0.9
F12-040	0.16	0.6	0.32	1.2
F12-060	0.24	0.9	0.47	1.8
F12-080	0.32	1.2	0.64	2.4
F12-090	0.37	1.4	0.74	2.8
F12-110	0.44	1.7	0.87	3.3
F12-125	0.50	1.9	0.99	3.8
F12-250	0.64	2.4	1.60	6.1