TIMKEN

TIMKEN® HMV / HMVC HYDRAULIC NUTS USER MANUAL

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INTRODUCTION

Hydraulic nuts are designed to install and remove tapered bore bearings with minimum effort. Better control of the mounting process allows for proper internal clearance reduction during installation, helping prevent poor fits and improper clearances that can cause premature bearing failures. Hydraulic nuts have been shown to considerably reduce the downtime during installation or removal of tapered bore bearings.

Hydraulic nuts can be efficiently used where the drive-up force on locknuts by wrenches is not sufficient. They can also be used for withdrawal sleeves, mounting of couplings, gearwheels and demounting of sleeve-mounted bearings.

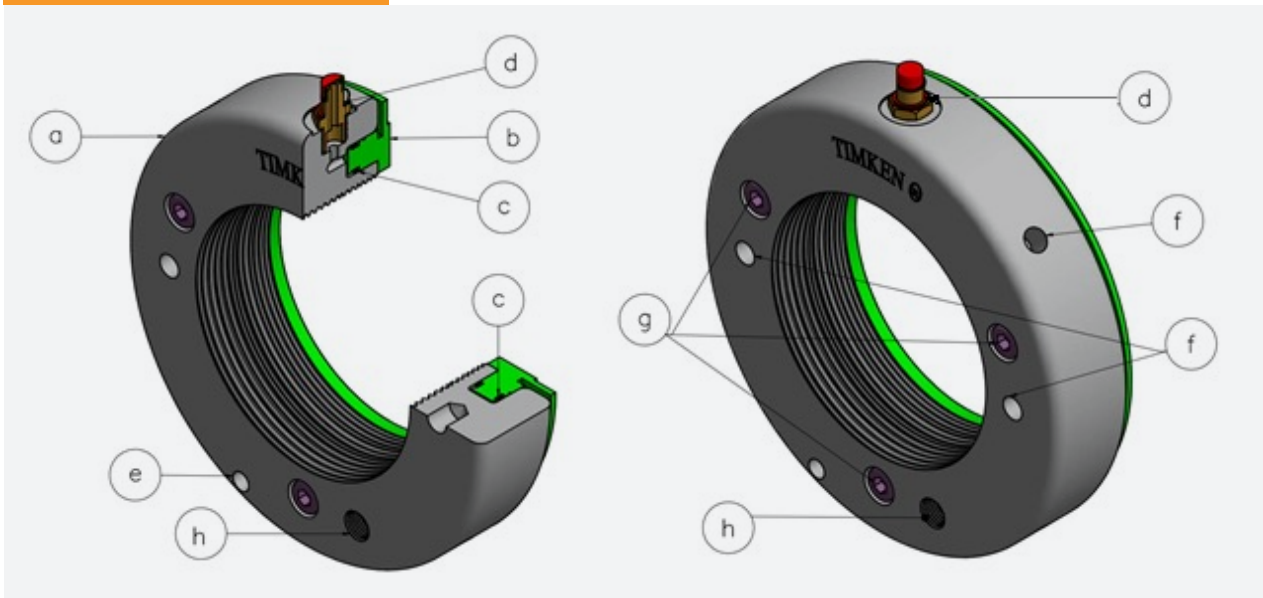


Fig. 1: Sectional detail view of Hydraulic nut

CONSTRUCTION AND KEY FEATURES

The Hydraulic nut comprises of two main components: a piston ring and a threaded ring. The threaded ring (Fig. 1-a) has female threads to fasten on to the male thread of either a shaft or a tapered adaptor sleeve and it also has a cavity for piston on one side. The piston (Fig. 1-b) is made to fit into the piston cavity made on the threaded ring. O-rings (Fig. 1-c) are used to ensure that the pressurized chamber of the hydraulic nut does not leak. The hydraulic nut has two G-1/4" threaded holes and comes with a G 1/4" male quick connect nipple & sealing washer (Fig. 1-d), one G-1/4" threaded holes on the circumference and one on the front face, to make sure the hydraulic line can be connected in even when space is limited. The other hole is sealed with a ball plug (Fig. 1-h). There is a dial indicator hole on the front face which can be used for mounting the dial indicator, which is used for measuring axial movement (Fig. 1-e) and there is a Nylon screw radially to secure the dial indicator. There are two radial blind holes (Fig. 1-f), circumferentially, and two blind holes on the front face of threaded ring to allow the operator to use a (supplied) tommy bar to spin the hydraulic nut up to the initial contact point with the locking mechanism. There are three threaded holes drilled into the oil pressure chamber and plugged with socket head cap screws (SHCS) & copper washers (Fig. 1-g). These are for piston removal in case of O-ring breakage or replacement (a set of spare O-rings are also supplied with the hydraulic nut).

Timken hydraulic nuts are provided with spare components and accessories, listed below:

- Spare O-rings
- Tommy bar (metal round bar)
- Eye bolt: on sizes HMV(C)-60 and above to ease the handling
- Nylon screw (to secure dial indicator)
- 4 mm Allen key for Threaded pins
- 6 mm Allen key to drive SHCS
- PVC hole plug for dial indicator hole
- Threaded pins (to removed piston for O-ring replacement)
- M8 Flat Copper Sealing Washers
- 3/8" NPT Female Quick Connect Coupling
- G 1/4" Sealing Washer

WARNINGS AND CAUTIONS

As high pressures/forces constitute a potential safety risk, please observe the following warnings.

⚠WARNING
Failure to observe the following warnings could create a risk of death or serious injury.

Only trained personnel should operate the equipment.

Always follow the operating instructions.

Check the hydraulic nut and all accessories carefully before use.
Never use even slightly damaged components.

Make sure all air has been removed from the hydraulic system, before putting the equipment under pressure.

Do not use the hydraulic nut for applications other than mounting/dismounting bearings.

Always use a pressure gauge.

Always prevent the workpiece/tool from being projected upon sudden release of pressure
(e.g. by use of retaining nut).

Do not exceed the maximum permitted piston displacement.

Nuts should be lifted and handled in accordance with safe working practices.

Steel lifting cables should not be directly applied to the nut, as they could damage the nut threads.

Eye bolts must be properly fitted wherever applicable.

In case of any concerns regarding the use of the hydraulic nut, contact Timken.

CAUTION
Failure to follow these cautions may result in property damage

Should the oil start to leak from the piston area, it is possible that the O-ring seals are damaged or worn and need to be replaced (see O-ring replacement).

When the hydraulic nut is not in use, ensure that the threaded holes are plugged to prevent entry of contaminants in the piston cavity.

To help prevent against corrosion during storage, apply a coat of light oil on the hydraulic nut surfaces.

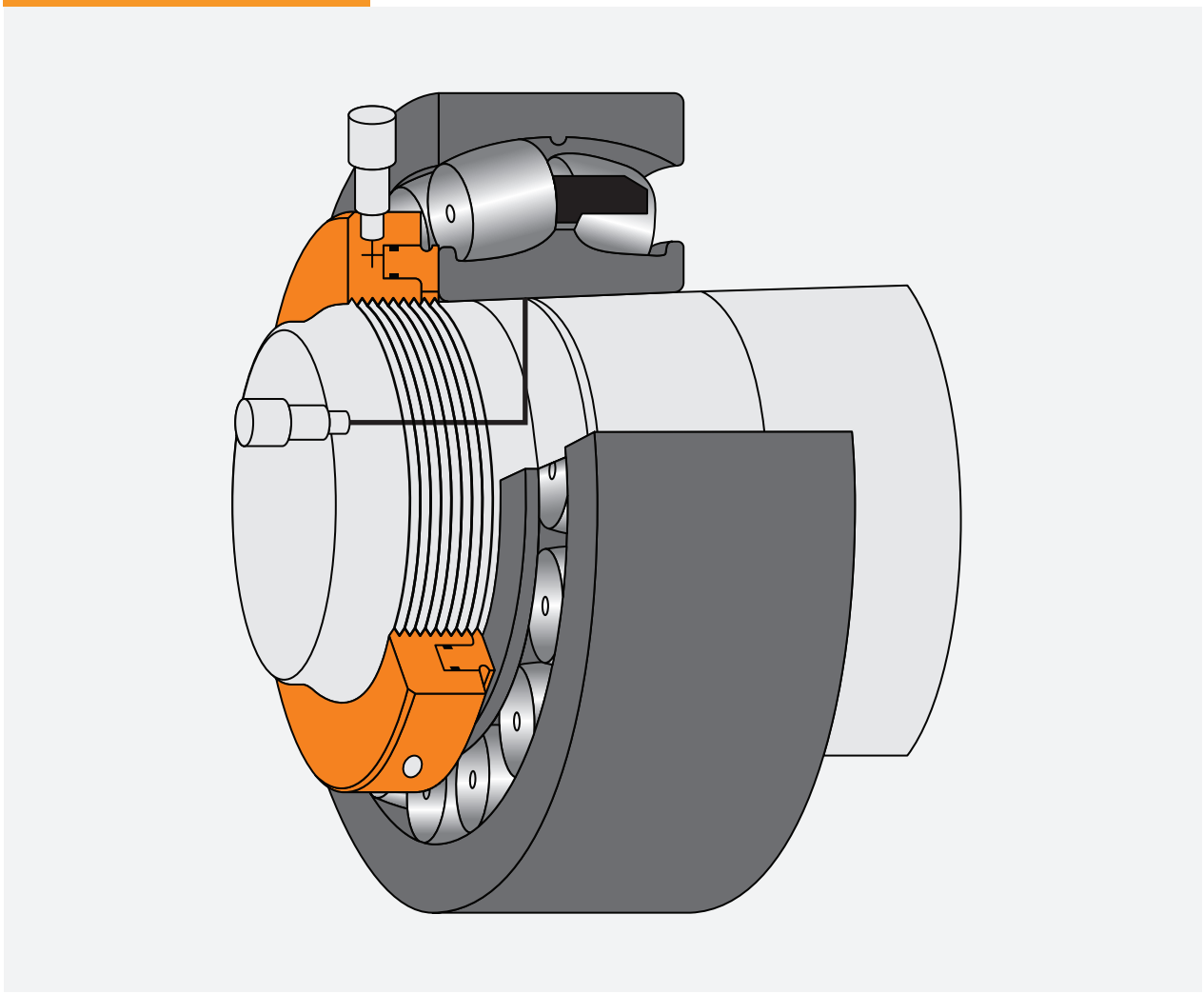


Fig. 2

BEARING MOUNTING AND DISMOUNTING WITH HYDRAULIC NUTS

Spherical roller bearing shown in Fig. 2 is driven up directly on tapered shaft. First the bearing is placed on the tapered seat, and the hydraulic nut is screwed onto the shaft until the bearing sits firmly on the shaft. The bearing is driven upon its seat by actuating the hydraulic nut. The amount of axial displacement of the bearing depends on the required amount of radial internal clearance (RIC) reduction. When driving the bearing onto the tapered seat, the RIC must be checked using feeler gauge. With the hydraulic method, the oil pressure must be relieved for RIC measuring. If the RIC can't be measured, e.g., because of space limitations or if the housed unit is sealed, not permitting to do so, the axial displacement can be measured instead.

In Table 1, values to achieve the required RIC reduction and the corresponding axial displacement for spherical roller bearings are listed.

Table 1: Axial Displacement

BORE (NOMINAL)		RADIAL INTERNAL CLEARANCE PRIOR TO MOUNTING						SUGGESTED REDUCTION OF RIC DUE TO INSTALLATION		AXIAL DISPLACEMENT OF INNER RING FOR RIC REDUCTION – TAPERED SHAFT[1][2]				MINIMUM PERMISSIBLE RIC AFTER INSTALLATION[1]		
		NORMAL C0				C4				1:12 TAPER		1:30 TAPER				
		MIN.		MAX.		MIN.		MAX.								
		C2		C3		C5										
OVER	INCL.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	C0	C3	C4
mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.	mm in.
20 0.9449	**30** 1.1811	**0.020** 0.0008	**0.030** 0.0012	**0.040** 0.0016	**0.055** 0.0022	**0.075** 0.0030	**0.095** 0.0037	**0.015** 0.0006	**0.020** 0.0008	**0.230** 0.0091	**0.300** 0.0118	– –	– –	**0.015** 0.0006	**0.025** 0.0010	**0.040** 0.0016
30 1.1811	**40** 1.5748	**0.025** 0.0010	**0.035** 0.0014	**0.050** 0.0020	**0.065** 0.0026	**0.085** 0.0033	**0.105** 0.0041	**0.020** 0.0008	**0.025** 0.0010	**0.300** 0.0118	**0.380** 0.0150	– –	– –	**0.015** 0.0006	**0.025** 0.0010	**0.040** 0.0016
40 1.5748	**50** 1.9685	**0.030** 0.0012	**0.045** 0.0018	**0.060** 0.0024	**0.080** 0.0031	**0.100** 0.0039	**0.130** 0.0051	**0.025** 0.0010	**0.030** 0.0012	**0.380** 0.0150	**0.460** 0.0181	– –	– –	**0.02** 0.0008	**0.030** 0.0012	**0.050** 0.0020
50 1.9685	**65** 2.5591	**0.040** 0.0016	**0.055** 0.0022	**0.075** 0.0030	**0.095** 0.0037	**0.120** 0.0047	**0.160** 0.0063	**0.030** 0.0012	**0.038** 0.0015	**0.460** 0.0181	**0.560** 0.0220	– –	– –	**0.025** 0.0010	**0.040** 0.0015	**0.060** 0.0025
65 2.5591	**80** 3.1496	**0.050** 0.0020	**0.070** 0.0028	**0.0950** 0.0037	**0.120** 0.0047	**0.150** 0.0059	**0.200** 0.0079	**0.038** 0.0015	**0.051** 0.0020	**0.560** 0.0220	**0.760** 0.0299	– –	– –	**0.025** 0.0010	**0.045** 0.0017	**0.075** 0.0030
80 3.1496	**100** 3.9370	**0.055** 0.0022	**0.080** 0.0030	**0.110** 0.0043	**0.140** 0.0055	**0.180** 0.0071	**0.230** 0.0091	**0.046** 0.0018	**0.064** 0.0025	**0.680** 0.0268	**0.970** 0.0382	– –	– –	**0.036** 0.0014	**0.050** 0.0020	**0.075** 0.0030
100 3.9370	**120** 4.7244	**0.065** 0.0026	**0.100** 0.0039	**0.135** 0.0053	**0.170** 0.0067	**0.220** 0.0087	**0.280** 0.0110	**0.051** 0.0020	**0.071** 0.0028	**0.760** 0.0299	**1.070** 0.0421	**1.900** 0.0748	**2.540** 0.1000	**0.051** 0.0020	**0.060** 0.0025	**0.100** 0.0040
120 4.7244	**140** 5.5118	**0.080** 0.0031	**0.120** 0.0047	**0.160** 0.0063	**0.200** 0.0079	**0.260** 0.0102	**0.330** 0.0130	**0.064** 0.0025	**0.089** 0.0035	**0.890** 0.0350	**1.270** 0.0500	**2.290** 0.0902	**3.050** 0.1201	**0.056** 0.0022	**0.075** 0.0030	**0.115** 0.0045
140 5.5118	**160** 6 .2992	**0.090** 0.0035	**0.130** 0.0051	**0.180** 0.0071	**0.230** 0.0091	**0.300** 0.0118	**0.380** 0.0150	**0.076** 0.0030	**0.102** 0.0040	**1.140** 0.0449	**1.520** 0.0598	**2.670** 0.1051	**3.430** 0.1350	**0.056** 0.0022	**0.075** 0.0030	**0.125** 0.0050
160 6 .2992	**180** 7.0866	**0.100** 0.0039	**0.140** 0.0055	**0.200** 0.0079	**0.260** 0.0102	**0.340** 0.0134	**0.430** 0.0169	**0.076** 0.0030	**0.114** 0.0045	**1.140** 0.0449	**1.650** 0.0650	**2.670** 0.1051	**4.060** 0.1598	**0.061** 0.0024	**0.090** 0.0035	**0.150** 0.0060
180 7.0866	**200** 7.8740	**0.110** 0.0043	**0.160** 0.0063	**0.220** 0.0087	**0.290** 0.0114	**0.370** 0.0146	**0.470** 0.0185	**0.089** 0.0035	**0.127** 0.0050	**1.400** 0.0551	**1.900** 0.0748	**3.050** 0.1201	**4.450** 0.1752	**0.071** 0.0028	**0.100** 0.0040	**0.165** 0 0065
200 7.8740	**225** 8.8582	**0.120** 0.0047	**0.180** 0.0071	**0.250** 0.0098	**0.320** 0.0126	**0.410** 0.0161	**0.520** 0.0205	**0.102** 0.0040	**0.140** 0.0055	**1.520** 0.0598	**2.030** 0.0799	**3.560** 0.1402	**4.830** 0.1902	**0.076** 0.0030	**0.115** 0.0045	**0.180** 0.0070
225 8.8582	**250** 9.8425	**0.140** 0.0055	**0.200** 0.0079	**0.270** 0.0106	**0.350** 0.0138	**0.450** 0.0177	**0.570** 0.0224	**0.114** 0.0045	**0.152** 0.0060	**1.780** 0.0701	**2.290** 0.0902	**4.060** 0.1598	**5.330** 0.2098	**0.089** 0.0035	**0.115** 0.0045	**0.200** 0.0080
250 9.8425	**280** 11.0236	**0.150** 0.0059	**0.220** 0.0087	**0.300** 0.0118	**0.390** 0.0154	**0.490** 0.0193	**0.620** 0.0244	**0.114** 0.0045	**0.165** 0.0065	**1.780** 0.0701	**2.540** 0.1000	**4.060** 0.1598	**5.840** 0.2299	**0.102** 0.0040	**0.140** 0.0055	**0.230** 0.0090
280 11.0236	**315** 12.4016	**0.170** 0.0067	**0.240** 0.0094	**0.330** 0.0130	**0.430** 0.0169	**0.540** 0.0213	**0.680** 0.0268	**0.127** 0.0050	**0.178** 0.0070	**1.900** 0.0748	**2.670** 0.1051	**4.450** 0.1752	**6.220** 0.2449	**0.102** 0.0040	**0.150** 0.0060	**0.250** 0.0100
315 12.4016	**355** 13.9764	**0.190** 0.0075	**0.270** 0.0106	**0.360** 0.0142	**0.470** 0.0185	**0.590** 0.0232	**0.740** 0.0291	**0.140** 0.0055	**0.190** 0.0075	**2.030** 0.0799	**2.790** 0.1098	**4.830** 0.1902	**6.600** 0.2598	**0.114** 0.0045	**0.165** 0.0065	**0.280** 0.0110
355 13.9764	**400** 15.7480	**0.210** 0.0083	**0.300** 0.0118	**0.400** 0.0157	**0.520** 0.0205	**0.650** 0.0256	**0.820** 0.0323	**0.152** 0.0060	**0.203** 0.0080	**2.290** 0.0902	**3.050** 0.1201	**5.330** 0.2098	**7.110** 0.2799	**0.127** 0.0050	**0.190** 0.0075	**0.330** 0.0130
400 15.7480	**450** 17.7165	**0.230** 0.0091	**0.330** 0.0130	**0.440** 0.0173	**0.570** 0.0224	**0.720** 0.0283	**0.910** 0.0358	**0.165** 0.0065	**0.216** 0.0085	**2.540** 0.1000	**3.300** 0.1299	**5.840** 0.2299	**7.620** 0.3000	**0.152** 0.0060	**0.230** 0.0090	**0.360** 0.0140
450 17.7165	**500** 19.6850	**0.260** 0.0102	**0.370** 0.0146	**0.490** 0.0193	**0.630** 0.0248	**0.790** 0.0311	**1.000** 0.0394	**0.178** 0.0070	**0.229** 0.0090	**2.670** 0.1051	**3.430** 0.1350	**6.220** 0.2449	**8.000** 0.3150	**0.165** 0.0065	**0.270** 0.0105	**0.410** 0.0160
500 19.6850	**560** 22.0472	**0.290** 0.0114	**0.410** 0.0161	**0.540** 0.0213	**0.680** 0.0268	**0.870** 0.0343	**1.100** 0.0433	**0.203** 0.0080	**0.254** 0.0100	**3.050** 0.1201	**3.810** 0.1500	**7.110** 0.2799	**8.890** 0.3500	**0.178** 0.0070	**0.290** 0.0115	**0.440** 0.0175
560 22.0472	**630** 24.8031	**0.320** 0.0126	**0.460** 0.0181	**0.600** 0.0236	**0.760** 0.0299	**0.980** 0.0386	**1.230** 0.0484	**0.229** 0.0090	**0.279** 0.0110	**3.430** 0.1350	**4.190** 0.1650	**8.000** 0.3150	**9.780** 0.3850	**0.203** 0.0080	**0.320** 0.0125	**0.510** 0.0200
630 24.8031	**710** 27.9528	**0.350** 0.0138	**0.510** 0.0201	**0.670** 0.0264	**0.850** 0.0335	**1.090** 0.0429	**1.360** 0.0535	**0.254** 0.0100	**0.305** 0.0120	**3.810** 0.1500	**4.570** 0.1799	**8.890** 0.3500	**10.670** 0.4201	**0.203** 0.0080	**0.370** 0.0145	**0.550** 0.0215
710 27.9528	**800** 31.4961	**0.390** 0.0154	**0.570** 0.0224	**0.750** 0.0295	**0.960** 0.0378	**1.220** 0.0480	**1.500** 0.0591	**0.279** 0.0110	**0.356** 0.0140	**4.190** 0.1650	**5.330** 0.2098	**9.780** 0.3850	**12.450** 0.4902	**0.229** 0.0090	**0.390** 0.0155	**0.610** 0.0240
800 31.4961	**900** 35.4331	**0.440** 0.0173	**0.640** 0.0252	**0.840** 0.0331	**1.070** 0.0421	**1.370** 0.0539	**1.690** 0.0665	**0.305** 0.0120	**0.381** 0.0150	**4.570** 0.1799	**5.720** 0.2252	**10.670** 0.4201	**13.330** 0.5248	**0.252** 0.0100	**0.460** 0.0180	**0.690** 0.0270
900 35.4331	**1000** 39.3701	**0.490** 0.0193	**0.710** 0.0280	**0.930** 0.0366	**1.190** 0.0469	**1.520** 0.0598	**1.860** 0.0732	**0.356** 0.0140	**0.432** 0.0170	**5.330** 0.2100	**6.480** 0.2551	**12.450** 0.4902	**15.110** 0.5949	**0.279** 0.0110	**0.490** 0.0195	**0.750** 0.0300
1000 39.3701	**1120** 44.0950	**0.530** 0.0209	**0.770** 0.0303	**1.030** 0.0406	**1.300** 0.0512	**1.670** 0.0657	**2.050** 0.0807	**0.400** 0.0160	**0.480** 0.0190	**6.100** 0.2400	**7.240** 0.2850	**14.220** 0.5600	**16.890** 0.6650	**0.280** 0.0110	**0.550** 0.0215	**0.810** 0.0320
1120 44.0950	**1250** 49.2130	**0.570** 0.0224	**0.830** 0.0327	**1.120** 0.0441	**1.420** 0.0559	**1.830** 0.0720	**2.250** 0.0886	**0.430** 0.0170	**0.500** 0.0200	**6.480** 0.2550	**7.620** 0.3000	**15.110** 0.5950	**17.780** 0.7000	**0.330** 0.0130	**0.610** 0.0240	**0.910** 0.0360

Note: Axial displacement values apply to solid steel shafts or hollow shafts with bore diameter less than half the shaft diameter. For shaft materials other than steel, or forthin-walled shafts, please consult your Timken sales engineer.

[1]This displacement is valid for assembly of tapered bore bearings and is measured starting from a line-to-line fit of the bearing bore to the tapered shaft.

[2]1:12 Taper used for 213, 222, 223, 230, 231, 232, 233, 238, 239 series. 1:30 Taper used for 240, 241, 242 series. For sleeve mounting, multiply axial displacement values by 1.1 for 1:12 Taper or by 1.05 for 1:30 Taper. For questions on tapered shaft data, consult your Timken sales engineer.

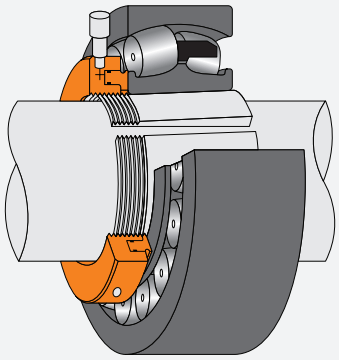


Fig. 3

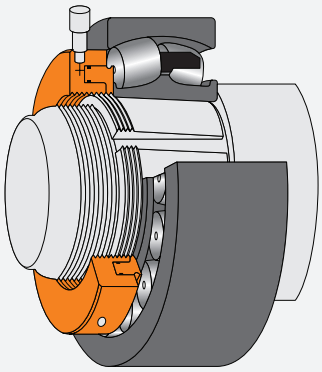


Fig. 4

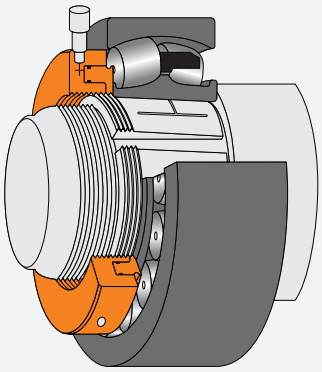


Fig. 5

Bearing can also be mounted onto the adapter or tapered sleeve, as described in Fig. 3. The bearing is to be placed and then pushed up to the tapered sleeve by activating the hydraulic nut until the bearing gets locked through interference and required RIC is achieved.

Hydraulic nut can be used to remove a withdrawal sleeve as shown in Fig. 4.

Hydraulic nuts are also suitable for dismounting of hydraulic withdrawal sleeves, see Fig. 5. When the nut is powered, since the bearing movement is stopped by the shoulder of shaft, the sleeve will be withdrawn out of the bearing.

OPERATING INSTRUCTIONS

Mounting

1. Inspect hydraulic system hoses, pipes, and pipe connections visually for leaks and make sure the joints are leakproof.
2. The maximum pressure permissible in the HMV series hydraulic nut is as follows.
   - HMV(C) 10 - 60: 80 MPa (11600 psi)
   - HMV(C) 62 - 100: 50 MPa (7250 psi)
   - HMV(C) 102 - 236: 30 MPa (4350 psi)
3. The recommended oil viscosity is 1400 SUS (300cSt) at operating temperature (SAE 90 oil).
4. Initially, the piston must be in the innermost position.
   - For this operation, please ensure the valve of the hydraulic hose is disconnected from the nut so the nut is not under pressure.
5. Threads are to be lubricated before mounting the nut onto the shaft or the sleeve.
6. Position the hydraulic nut concentric to the shaft or tapered sleeve. This can be done manually for smaller sizes, but if the nut is of larger size, supporting tool and fixtures to be used to avoid cross threading on shaft or taper sleeve.

7. Screw the hydraulic nut on the thread of the tapered sleeve or shaft until the piston makes initial contact with the surface of the bearing's inner ring.
8. One of the two threaded holes must be plugged with the G ¼" ball plug before the hydraulic nut is pressurized. Keep the plug loose to purge air in next step.
9. Connect the hydraulic pressure system to the male connector and pump the oil out through the hydraulic lines to purge out the air from the hydraulic system before putting the nut under pressure. When you see oil coming from the ball valve, stop the pump and tighten the ball plug.
10. Power the nut until the piston meets bearing inner ring and place the dial gauge and set to zero.
11. Gradually increase the pressure and watch for the required axial displacement of piston (refer axial displacement table 1) and suggested RIC is attained in the bearing.
12. To avoid overextension of the piston, it's stroke should only be permitted to the overextension piston groove on the OD of the piston shows in Fig. 6. If the overextension piston groove travels past the face of the female threaded ring, the hydraulic nut can be damaged.
13. After mounting has completed, depressurize the pump to unload the nut.
14. Piston to be retracted into the nut. This can be done by further threading the nut up the shaft of bearing sleeve once after the the pump has been depressurized.

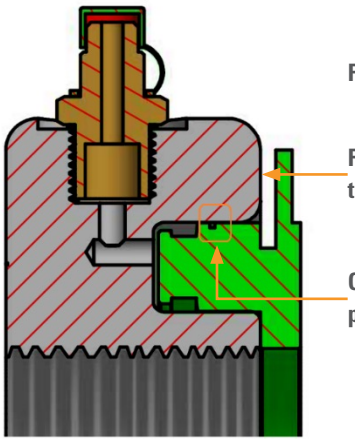


Fig. 6

Dismounting

- For dismounting, thread the hydraulic nut onto the withdrawal sleeve thread until the piston meets the bearing's inner ring.
- For threaded sleeve, thread the hydraulic nut onto the shaft and the piston should meet the sleeve end. A stop ring is used to stop the bearing and to let the sleeve slide in against the taper.
- All mountings to be made and visual inspections to be done as described in mounting instructions.
- Pressurize the nut, the sleeve will be withdrawn from the bearing or the bearing will be pushed off the taper sleeve.
- Pump to be depressurized and the piston to be retracted into the nut.

ORDERING OF THE SPARE COMPONENTS

Spare kit is same for both HMV and HMVC Hydraulic nuts.

To order spare components for the hydraulic nuts, contact your local Timken sales representative.

PART NUMBER	DESCRIPTION	QTY.
HMV-SPAREKIT	**Component (Maintenance) Kit (Same for All Sizes)**	
	G 1/4 Sealing Washer	1
	M8 x 40 mm Threaded Pins	3
	M5 x 10 mm Nylon Cheese Head Screw	10
	M8 Flat Copper Sealing Washer	3
	M8 x 12 MM Socket Head Cap Screw	3
HMV-N-SEALKIT	**O-ring Seal Kits***	
	Inner O-Ring	1
	Outer O-Ring	1
HMV-G1/4-NW	**Male Nipple w/Sealing Washer (Same for All Sizes)**	
	G 1/4 Sealing Washer 100 MPa	1
	G 1/4 Male Nipple 100 MPa	1
HMV-3/8NPT-FC	**3/8 NPT Female Quick Connect Coupling 100 MPa (Same for All Sizes)**	1
HMV-G1/4-BP	**Ball Plug (Same for All Sizes)**	1

* Part Number varies depending on size. N = Hydraulic Nut Size
For example: HMV-10-SEALKIT

O-RING REPLACEMENT

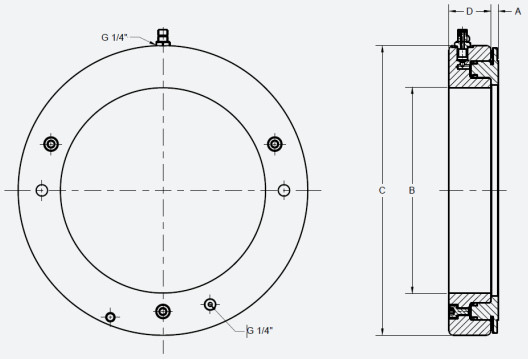
1. Remove (3) SHCS (fig. 1-g).
2. Replace with (3) Threaded pins using 4 mm Allen key to drive piston out.
3. Remove O-rings, clean all surfaces and inspect for any damage to O-ring surfaces.
4. Remove (3) Threaded Pins.
5. Replace both inner and outer O-rings.
6. Place nut level over piston and assemble. Assembly should feel smooth, if not remove piston and verify O-rings are still in groove.
7. Reinstall (3) SHCS with (3) M8 Flat Copper Sealing Washers.

ENGINEERING SERVICES

Special applications should be referred to Timken sales engineers for review.

HMV

PART NUMBER SPECIFICATIONS



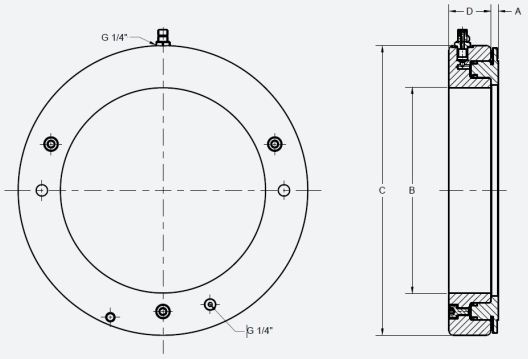
PART NUMBER	THREADS	DIMENSIONS			PISTON TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
		C	D	A			
	B	mm	mm	mm	mm	mm^2	kg
HMV-10	M 50 X 1.5	114	38	4	5	2900	2.5
HMV-12	M 60 X 2	125	38	5	5	3200	2.8
HMV-13	M 65 X 2	135	38	5	5	3500	3.0
HMV-14	M 70 X 2	140	38	5	5	3900	3.3
HMV-15	M 75 X 2	145	38	5	5	4100	3.5
HMV-16	M 80 X 2	150	38	5	5	4200	3.8
HMV-17	M 85 X 2	155	38	5	5	4400	3.9
HMV-18	M 90 X 2	160	38	5	5	4800	4.1
HMV-19	M 95 X 2	165	38	5	5	5000	4.4
HMV-20	M 100 X 2	170	38	6	5	5200	4.5
HMV-21	M 105 X 2	175	38	6	5	5400	5.4
HMV-22	M 110 X 2	180	38	6	5	5700	5.7
HMV-23	M 115 X 2	185	38	6	5	5900	5.1
HMV-24	M 120 X 2	190	38	6	5	6100	5.3
HMV-25	M 125 X 2	195	38	6	5	6300	5.4
HMV-26	M 130 X 2	200	38	6	5	6500	5.7
HMV-27	M 135 X 2	205	38	6	5	6700	5.9
HMV-28	M 140 X 2	210	38	7	5	6900	6.1
HMV-29	M 145 X 2	215	39	7	5	7300	6.5
HMV-30	M 150 X 2	220	39	7	5	7500	6.6
HMV-31	M 155 X 3	225	39	7	5	8100	6.9
HMV-32	M 160 X 3	235	40	7	6	8600	7.7
HMV-33	M 165 X 3	240	40	7	6	9000	8.0

HMV-10 through HMV-40 have a Metric ISO fine-thread profile.
HMV-41 through HMV-236 have a Metric ISO trapezoidal thread.

HMV

PART NUMBER SPECIFICATIONS

continued



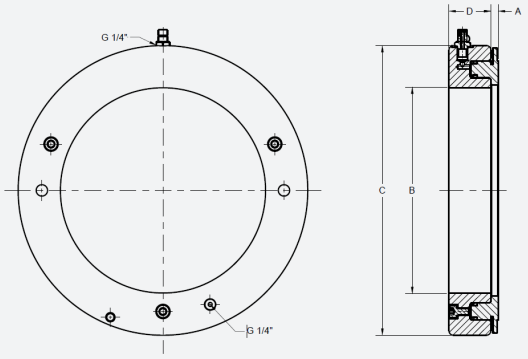
PART NUMBER	THREADS	DIMENSIONS			PISTON TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
		C	D	A			
	B	mm	mm	mm	mm	mm^2	kg
HMV-34	M 170 X 3	245	41	7	6	9500	8.4
HMV-36	M 180 X 3	255	41	7	6	10300	9.1
HMV-38	M 190 X 3	270	42	8	7	11500	10.8
HMV-40	M 200 X 3	280	43	8	8	12500	11.4
HMV-41	Tr 205 X 4	290	43	8	8	12900	12.2
HMV-42	Tr 210 X 4	295	44	8	9	13500	12.5
HMV-43	Tr 215 X 4	300	44	8	9	13800	13.0
HMV-44	Tr 220 X 4	305	44	8	9	14400	13.4
HMV-45	Tr 225 X 4	315	45	8	9	15200	14.6
HMV-46	Tr 230 X 4	320	45	8	9	15600	14.8
HMV-47	Tr 235 X 4	325	46	8	10	16200	16.0
HMV-48	Tr 240 X 4	330	46	9	10	16500	16.3
HMV-50	Tr 250 X 4	345	46	9	10	17800	17.6
HMV-52	Tr 260 X 4	355	47	9	11	18800	19.0
HMV-54	Tr 270 X 4	370	48	9	12	19700	20.4
HMV-56	Tr 280 X 4	380	49	9	12	21100	22.0
HMV-58	Tr 290 X 4	390	49	9	13	22600	22.5
HMV-60	Tr 300 X 4	405	51	10	14	23600	25.6
HMV-62	Tr 310 X 5	415	52	10	14	24900	27.0
HMV-64	Tr 320 X 5	430	53	10	14	26300	29.6
HMV-66	Tr 330 X 5	440	53	10	14	27000	31.0
HMV-68	Tr 340 X 5	450	53	10	14	28400	32.5
HMV-69	Tr 345 X 5	455	54	10	14	29400	33.6

HMV-10 through HMV-40 have a Metric ISO fine-thread profile.
HMV-41 through HMV-236 have a Metric ISO trapezoidal thread.

HMV

PART NUMBER SPECIFICATIONS

continued



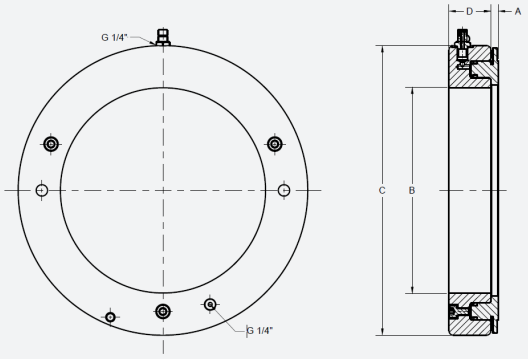
PART NUMBER	THREADS	DIMENSIONS			PISTON TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
		C	D	A			
	B	mm	mm	mm	mm	mm^2	kg
HMV-70	Tr 350 X 5	465	56	10	14	30000	35.0
HMV-72	Tr 360 X 5	475	56	10	15	31300	37.0
HMV-73	Tr 365 X 5	482	57	11	15	31700	38.5
HMV-74	Tr 370 X 5	490	57	11	16	32800	39.2
HMV-76	Tr 380 X 5	500	58	11	16	33600	41.0
HMV-77	Tr 385 X 5	505	58	11	16	34700	42.0
HMV-80	Tr 400 X 5	525	60	11	17	36700	46.0
HMV-82	Tr 410 X 5	535	61	11	17	38300	48.2
HMV-84	Tr 420 X 5	545	61	11	17	40000	50.4
HMV-86	Tr 430 X 5	555	62	11	17	40800	53.0
HMV-88	Tr 440 X 5	565	62	12	17	42500	55.0
HMV-90	Tr 450 X 5	580	64	12	17	44100	58.2
HMV-92	Tr 460 X 5	590	64	12	17	45000	61.0
HMV-94	Tr 470 X 5	600	65	12	18	46900	63.7
HMV-96	Tr 480 X 5	612	65	12	19	48500	65.0
HMV-98	Tr 490 X 5	625	66	12	19	49800	69.0
HMV-100	Tr 500 X 5	635	67	12	19	52000	71.5
HMV-102	Tr 510 X 6	645	68	12	20	53300	75.0
HMV-104	Tr 520 X 6	657	68	13	20	54200	77.0
HMV-106	Tr 530 X 6	670	69	13	21	56200	80.0
HMV-108	Tr 540 X 6	680	69	13	21	58200	83.0
HMV-110	Tr 550 X 6	692	70	13	21	59200	86.0
HMV-112	Tr 560 X 8	705	71	13	22	61200	90.0

HMV-10 through HMV-40 have a Metric ISO fine-thread profile.
HMV-41 through HMV-236 have a Metric ISO trapezoidal thread.

HMV

PART NUMBER SPECIFICATIONS

continued

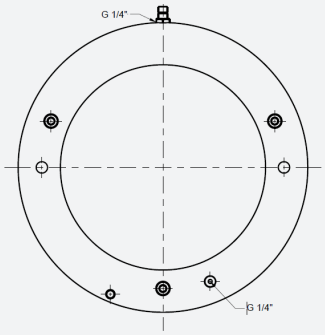


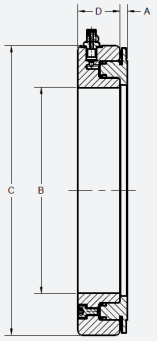
PART NUMBER	THREADS	DIMENSIONS			PISTON TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
		C	D	A			
	B	mm	mm	mm	mm	mm^2	kg
HMV-114	Tr 570 X 6	715	72	13	23	63200	93.0
HMV-116	Tr 580 X 6	725	72	13	23	64200	96.0
HMV-120	Tr 600 X 6	750	73	13	23	67400	100.0
HMV-126	Tr 630 X 6	780	74	14	23	72900	110.0
HMV-130	Tr 650 X 6	805	75	14	23	76200	116.0
HMV-134	Tr 670 X 6	825	76	14	24	79500	123.0
HMV-138	Tr 690 X 6	850	77	14	25	84200	130.0
HMV-142	Tr 710 X 7	870	78	15	25	87700	137.0
HMV-146	Tr 730 X 7	885	79	15	25	90000	143.0
HMV-150	Tr 750 X 7	915	79	15	25	97000	150.0
HMV-160	Tr 800 X 7	970	80	16	25	104000	173.0
HMV-170	Tr 850 X 7	1020	83	16	26	114600	190.0
HMV-180	Tr 900 X 7	1070	86	17	30	124000	210.0
HMV-190	Tr 950 X 8	1125	86	17	30	135600	238.0
HMV-200	Tr 1000 X 8	1180	88	17	34	145600	263.0
HMV-212	Tr 1060 X 8	1255	95	18	34	161200	325.0
HMV-216	Tr 1080 X 8	1280	100	18	34	167400	345.0
HMV-224	Tr 1120 X 8	1340	106	19	36	178200	410.0
HMV-236	Tr 1180 X 8	1420	115	22	40	189200	530.0

HMV-10 through HMV-40 have a Metric ISO fine-thread profile.
HMV-41 through HMV-236 have a Metric ISO trapezoidal thread.

HMVC

PART NUMBER SPECIFICATIONS





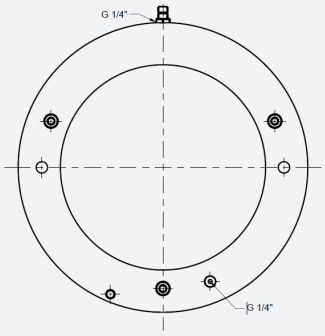
PART NUMBER	MAJOR DIA. B	THREADS NO. PER INCH	DIMENSIONS			PISTON LENGTH OF TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
			C	D	A			
			in.	in.	in.	in.	in.²	lbs.
HMVC-10	1.967	18	4.488	1.496	0.157	0.197	4.5	5.5
HMVC-12	2.360	18	4.921	1.496	0.197	0.197	5.0	6.2
HMVC-13	2.548	18	5.315	1.496	0.197	0.197	5.4	6.6
HMVC-14	2.751	18	5.512	1.496	0.197	0.197	6.0	7.3
HMVC-15	2.933	12	5.709	1.496	0.197	0.197	6.3	7.7
HMVC-16	3.137	12	5.906	1.496	0.197	0.197	6.5	8.4
HMVC-17	3.340	12	6.102	1.496	0.197	0.197	6.8	8.6
HMVC-18	3.527	12	6.299	1.496	0.197	0.197	7.4	9.0
HMVC-19	3.730	12	6.496	1.496	0.197	0.197	7.7	9.7
HMVC-20	3.918	12	6.693	1.496	0.236	0.197	8.1	10.0
HMVC-22	4.325	12	7.087	1.496	0.236	0.197	8.8	12.5
HMVC-24	4.716	12	7.480	1.496	0.236	0.197	9.5	11.7
HMVC-26	5.106	12	7.874	1.496	0.236	0.197	10.1	12.5
HMVC-28	5.497	12	8.268	1.496	0.276	0.197	10.7	13.4
HMVC-30	5.888	12	8.661	1.535	0.276	0.197	11.6	14.5
HMVC-32	6.284	8	9.252	1.575	0.276	0.236	13.3	17.0
HMVC-34	6.659	8	9.645	1.614	0.276	0.236	14.7	18.5
HMVC-36	7.066	8	10.039	1.615	0.276	0.236	16.0	20.0

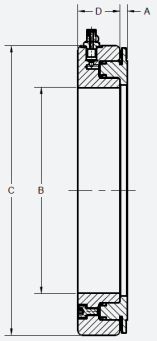
HMVC-10 through HMVC-64 have American National Threads Class 3.
HMVC-68 through HMVC-190 have Acme General Purpose Threads Class 3G.

HMVC

PART NUMBER SPECIFICATIONS

continued





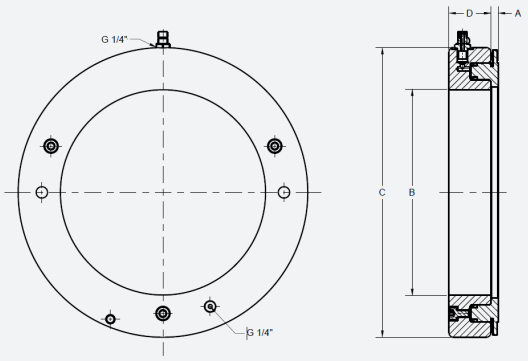
PART NUMBER	MAJOR DIA. B	THREADS NO. PER INCH	DIMENSIONS			PISTON LENGTH OF TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
			C	D	A			
			in.	in.	in.	in.	in.²	lbs.
HMVC-38	7.472	8	10.630	1.653	0.315	0.276	17.8	23.1
HMVC-40	7.847	8	11.024	1.693	0.315	0.276	19.4	25.1
HMVC-44	8.628	8	12.008	1.732	0.315	0.354	22.3	29.5
HMVC-48	9.442	6	12.992	1.811	0.354	0.394	25.6	35.9
HMVC-52	10.192	6	13.976	1.850	0.354	0.433	29.1	41.8
HMVC-56	11.004	6	14.961	1.929	0.354	0.472	32.7	48.4
HMVC-60	11.785	6	15.945	2.008	0.394	0.551	36.6	56.3
HMVC-64	12.562	6	16.929	2.087	0.394	0.551	40.8	65.1
HMVC-68	13.334	5	17.717	2.087	0.394	0.551	44.0	71.5
HMVC-72	14.170	5	18.701	2.205	0.394	0.590	48.5	81.4
HMVC-76	14.957	5	19.685	2.283	0.433	0.630	52.1	90.2
HMVC-80	15.745	5	20.669	2.362	0.433	0.669	56.9	101.2
HMVC-84	16.532	5	21.457	2.401	0.433	0.669	62.0	110.9
HMVC-88	17.319	5	22.244	2.441	0.472	0.669	65.9	121.0
HMVC-92	18.107	5	23.228	2.520	0.472	0.669	69.8	134.2
HMVC-96	18.894	5	24.094	2.559	0.472	0.748	75.2	143.0
HMVC-100	19.682	5	25.000	2.598	0.472	0.748	80.6	157.3
HMVC-106	20.867	4	26.378	2.716	0.512	0.827	87.1	176.0

HMVC-10 through HMVC-64 have American National Threads Class 3.
HMVC-68 through HMVC-190 have Acme General Purpose Threads Class 3G.

HMVC

PART NUMBER SPECIFICATIONS

continued



PART NUMBER	MAJOR DIA. B	THREADS NO. PER INCH	DIMENSIONS			PISTON LENGTH OF TRAVEL	PISTON AREA	ASSEMBLY WEIGHT
			C	D	A			
			in.	in.	in.	in.	$in.^2$	lbs.
HMVC-112	22.048	4	27.756	2.795	0.512	0.866	94.9	198.0
HMVC-120	23.623	4	29.528	2.874	0.512	0.905	104.5	220.0
HMVC-126	24.804	4	30.709	2.913	0.551	0.905	113.0	242.0
HMVC-134	26.379	4	32.480	2.992	0.551	0.945	123.2	270.6
HMVC-142	27.961	3	34.252	3.071	0.590	0.984	135.9	301.4
HMVC-150	29.536	3	36.024	3.110	0.590	0.984	150.4	330.0
HMVC-160	31.504	3	38.189	3.150	0.630	0.984	161.2	380.6
HMVC-170	33.473	3	40.157	3.268	0.630	1.024	177.6	418.0
HMVC-180	35.441	3	42.126	3.386	0.669	1.181	192.2	462.0
HMVC-190	37.410	3	44.291	3.386	0.669	1.181	210.2	523.6

HMVC-68 through HMVC-190 have Acme General Purpose Threads Class 3G.

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