

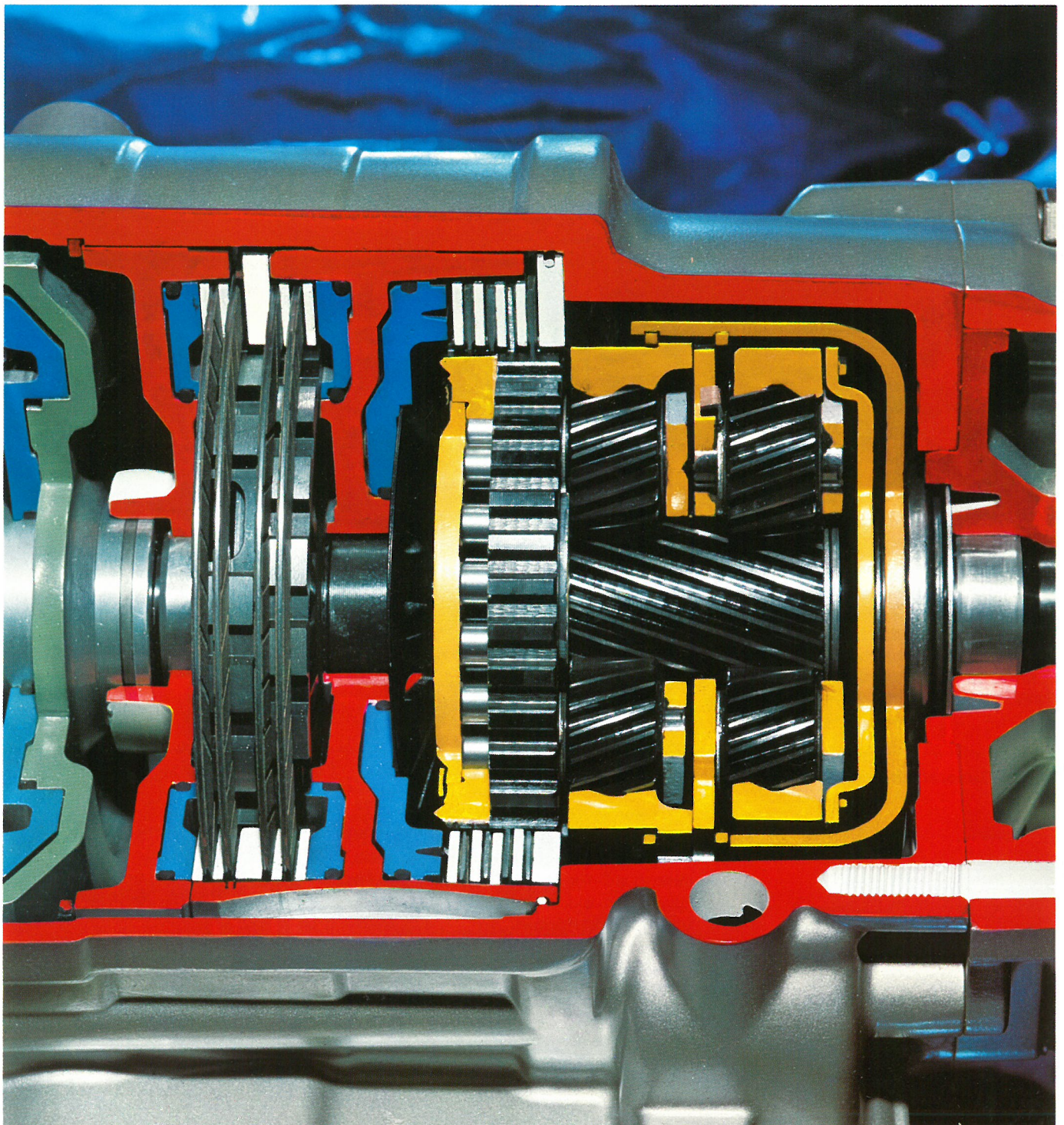
ZF 3 HP-22 Automatic Transmission for Passenger Cars



ZF DANMARK ApS

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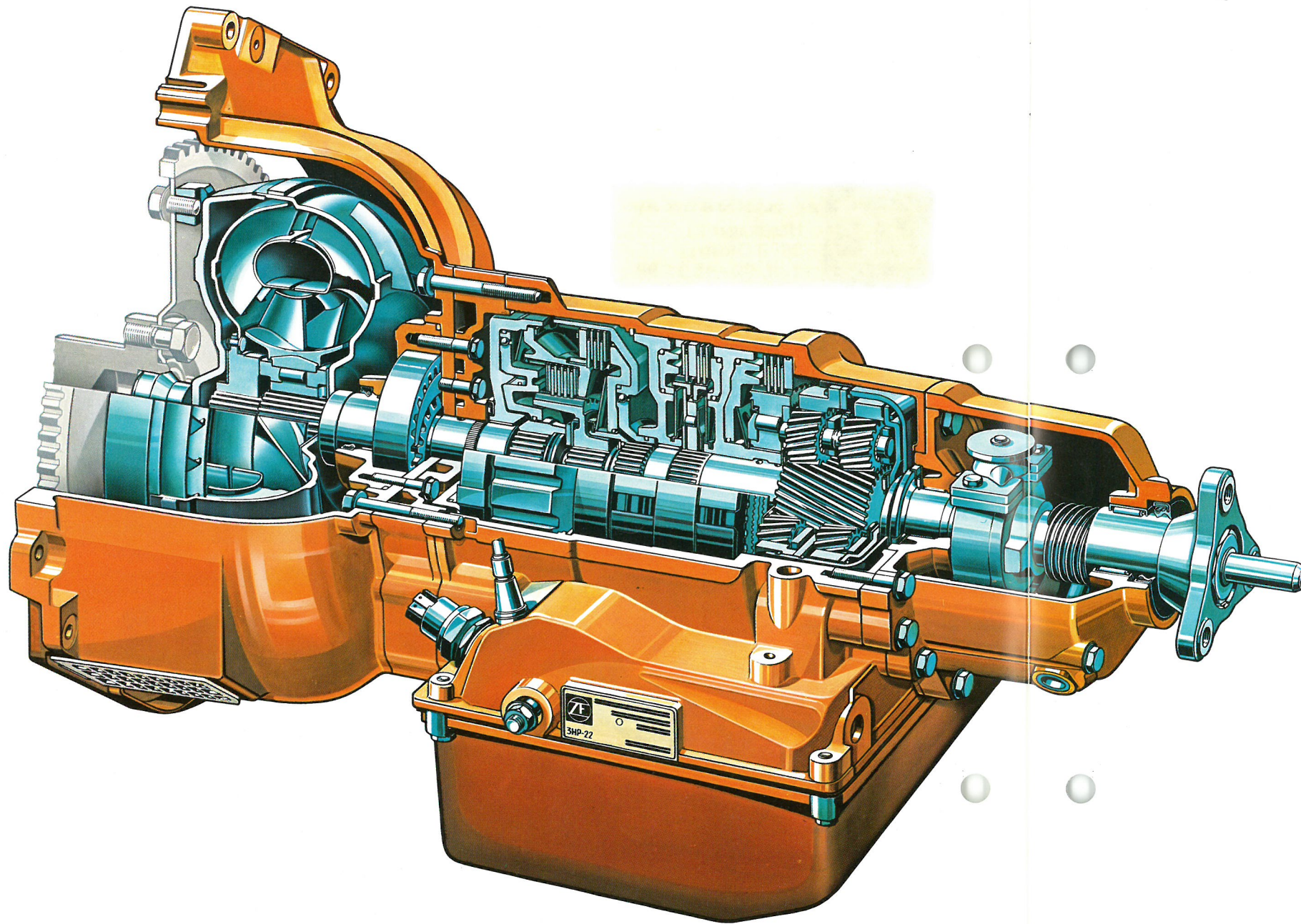


Fig. 1: General cutaway view of 3 HP-22

The ZF 3 HP-22 Automatic transmission

Times have changed. A lot of people who used to enjoy driving are beginning to think differently. This is particularly the case in town traffic, urban centers and on the motorways (expressways), especially during the holiday period. In spite of all the difficulties people still drive cars because there is often no other choice.

Industry has been trying for years to reduce the stress of driving and make the so-called "start-stop" traffic conditions more bearable. The automatic transmission - a major component of any car - makes a big contribution towards taking the effort out of driving. With a transmission that "thinks for itself" the driver can pay more attention to traffic situations. This contribution towards safety on the roads should not be underestimated.

The two-pedal layout makes driving easier and more comfortable.

Tests have shown that the stress connected with a manual gear shift is definitely higher - disregarding the considerably greater physical effort required. This means that those people who don't have to change gear stay healthier.

And it is not only the driver who benefits from automatic transmission, the car does as well. There is no clutch wear to worry about, no repairs or adjustments. The whole drive train from the engine, through the gearbox to the differential and right down to the tires is substantially preserved by the hydraulic system. Maintenance costs are reduced.

Automatic transmissions from Zahnradfabrik Friedrichshafen AG have been installed and demonstrated their worth in large numbers in the medium

to luxury range of cars. This was one of the reasons for opening a new ZF factory in Saarbrücken with modern production facilities. The 3 HP-22 is built there. The experience gained with its two predecessors 3 HP-12 and 3 HP-20 has been incorporated in the new model.

The 3 HP-22 is versatile. It is suitable for passenger cars as well as delivery trucks. Its range of power is such that it is ideal for use with low power engines and those in the heavyweight class - the favourable external dimensions remain the same. This adaptability is achieved by varying the layout of the converter, the number of friction discs in the hydraulic clutches and the number of planet gears - 3 to 4 - per planetary gear train.

When compared with a conventional gearbox the automatic transmission brings about only a slight increase in fuel consumption. Consumption can, in fact, be less in unfavourable conditions, e. g. in town traffic, where a car with a manual gearbox is often driven in a low gear with unnecessarily high engine speeds.



Fig. 2: The main components of the torque converter, from right to left: Impeller, stator, turbine.

Description

Hydrodynamic torque converter

The ZF automatic transmission has a converter which uses the well-known Trilok principle. This makes the clutch pedal superfluous and it is impossible to stall the engine. The converter can be adapted to a great extent to suit the engine being used. Its main components are impeller, turbine and stator with free-wheel unit. These components are arranged in a common housing in such a way that oil flows through them in a closed circuit.

Torque multiplication is at its greatest when the car is starting from a standstill. The stator, which deflects the oil to accelerate the impeller, is located on the housing by means of a free-wheel unit. As road speed increases, i. e. when impeller and turbine are rotating at approximately the same speed, the stator no longer produces any torque multiplication, it disengages from the housing and rotates

in the same direction as the impeller. The torque converter then acts as a fluid coupling.

Three-speed gearbox

A simple epicyclic gearbox with three forward and one reverse speed is mounted behind the torque converter. Considerable effort was made to produce a gearbox occupying a minimum of space and using as few components as possible. Hydraulically operated multi-disc clutches are used to effect the gear shifts. These do not wear and require no adjustment. Two free-wheel units are used to ensure that the gear shift takes place without loss of traction. A low-loss oil pump is fitted in the front casing of the gearbox.

It supplies oil to the converter, selector unit, gear shift and the lubrication system. The annulus of the epicyclic gearbox also has external teeth in which a pawl engages to prevent the vehicle rolling away while parked.

Selector unit

The selector unit with the selector valve, control pistons and pressure valves is situated on the underside of the transmission housing. The shift points are dependent on the throttle opening and the road speed of the vehicle. The centrifugal governor on the output shaft produces the pulses corresponding to the road speed.

Gears are changed automatically at predetermined points depending on the driving range selected.

When necessary the selector unit can be overridden by the driver by depressing the accelerator pedal fully (kick-down) to engage the next lowest gear for better acceleration. In this case the upward shift takes place at almost maximum permissible engine speed, i. e. only when the vehicle has reached a considerably higher speed. This, therefore, ensures that the engine power is fully utilized in each gear.

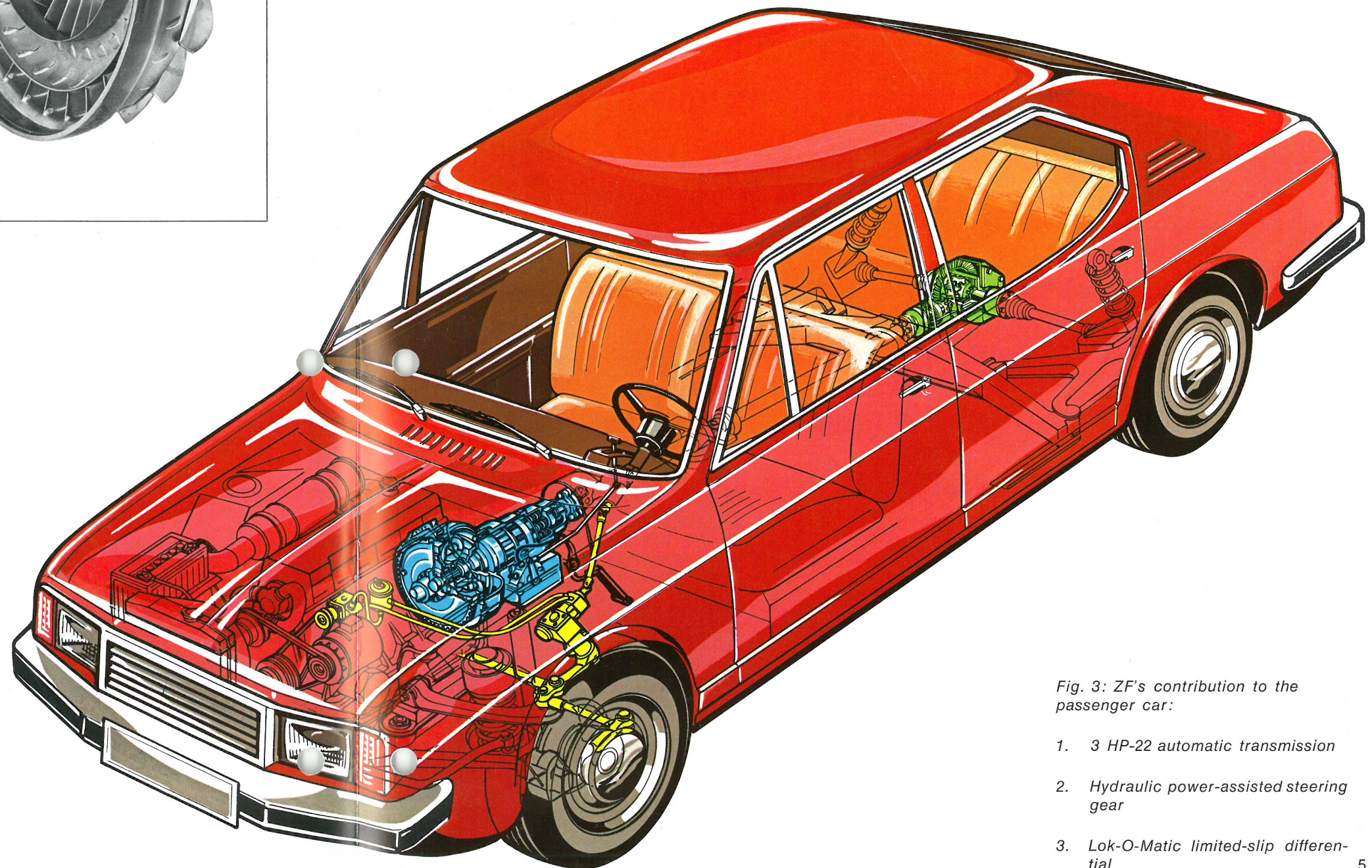


Fig. 3: ZF's contribution to the passenger car:

1. 3 HP-22 automatic transmission
2. Hydraulic power-assisted steering gear
3. Lok-O-Matic limited-slip differential

Operation

The transmission unit is operated by means of a selector lever which has an indicator with the following markings:

- P = Park. To be selected only when vehicle is at a standstill. The drive wheels are locked by the lock pawl on the gearbox output shaft.
- R = Reverse. Select only when vehicle is at a standstill.
- N = Neutral. The transmission is in neutral. The engine and drive wheels are de-coupled.
- A = Automatic. This is the normal drive position. The upward shifts to the 2nd and 3rd gear take place at the most economic points - fuel economy being the guiding principle. This position should be used in normal traffic conditions. A rapid downward shift for overtaking and, therefore, better acceleration in the gears is effected by using the kick-down. To obtain kick-down the accelerator pedal must be depressed fully to overcome the nominal resistance.
- 2 = Intermediate and engine braking. This position is used to advantage in mountainous regions and on long uphill or downhill gradients. In this position the transmission does not change above second gear. Engine power is fully utilized and engine braking is more effective.
- 1 = Low and engine braking. In this position the transmission is fixed in first gear. Select this range for difficult driving conditions on steep uphill or downhill gradients.

As can be seen from the above, the driver is not completely at the mercy of the automatic transmission. Even in position 'A' it is possible, in addition to kick-down, to achieve certain variations by appropriate regulation of the accelerator pedal. The gear shift points can, therefore, be varied within a limited range.

It is important to remember on downhill routes to shift back to range 2

or even 1 in good time to preserve the service brakes.

Installation

ZF automatic transmissions have about the same installed dimensions as conventional synchromesh gearboxes. There should, therefore, be no problems with installation. The converter bell housing and the transmission case with its mounting faces can be adapted to suit the vehicle layout.

Maintenance

This is confined to checking the oil level and carrying out oil changes at the prescribed intervals. Adjustments are not necessary even after prolonged periods of service.

ZF has a well equipped service network in Germany and abroad which is still being enlarged.

Subject to technical changes.

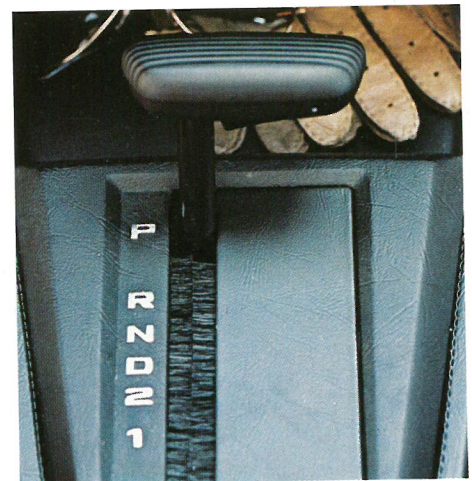
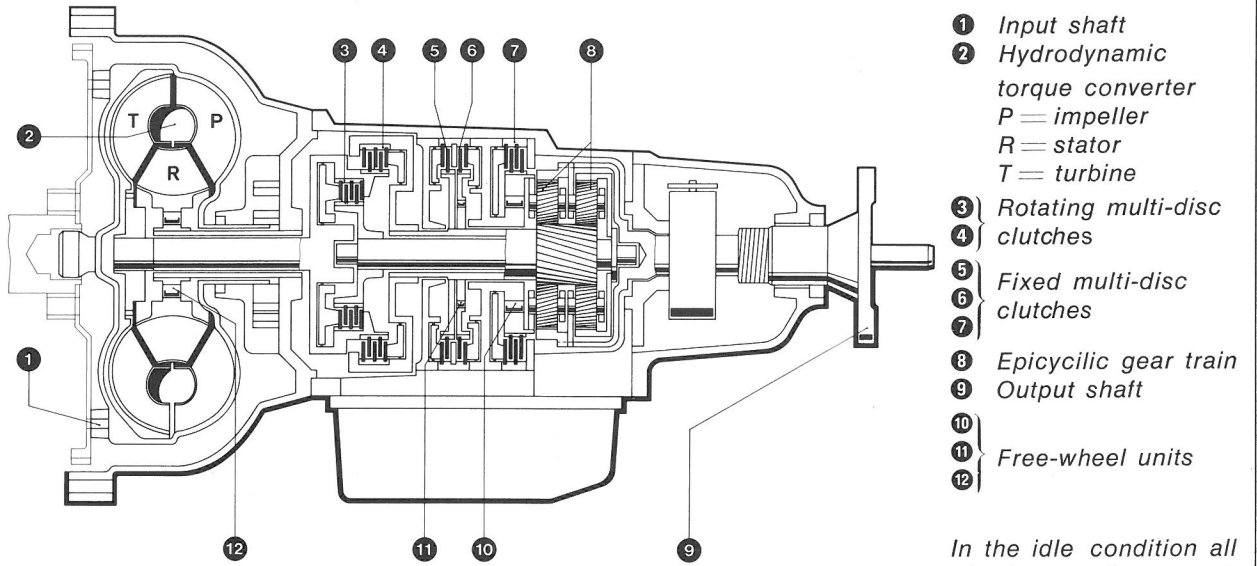
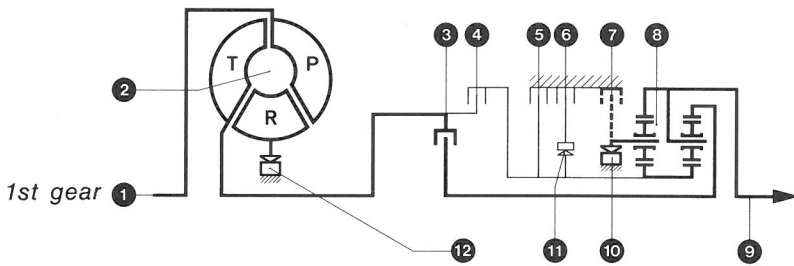


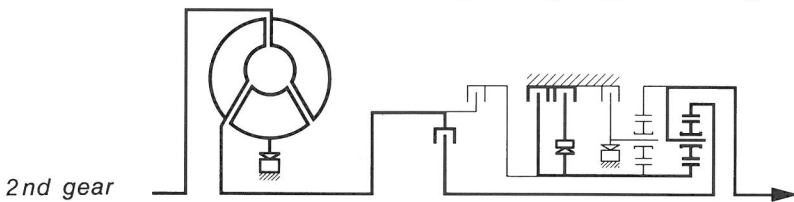
Fig. 4: Selector lever of ZF automatic transmission in two different makes of car



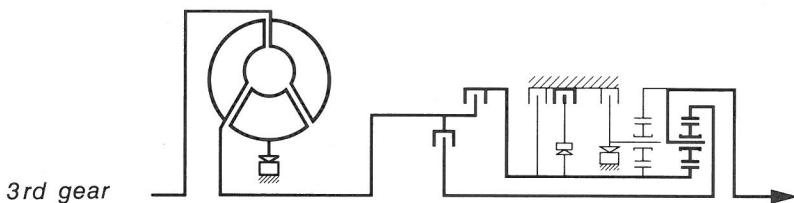
In the idle condition all clutches are disengaged.



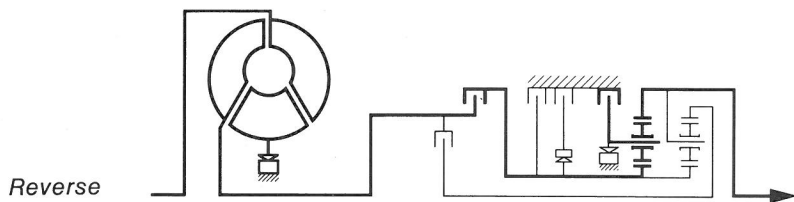
Clutch 3 is engaged. The planet carrier is locked to free-wheel unit 10 when the engine is pulling but is overrun when the engine is coasting. With the selector lever in driving range 1, clutch 7 is also engaged to permit engine braking.



Clutches 3, 5 and 6 are engaged. Free-wheel unit 10 is overrun. The hollow shaft with the sun wheel is locked.



Clutches 3, 4 and 6 are engaged. Free-wheel units 10 and 11 are overrun. The whole epicyclic gear train revolves as a solid block at engine speed.



Clutches 4 and 7 are engaged. The direction of rotation of the output shaft is reversed as the planet gear carrier is held stationary.

The bold lines indicate the power flow in 1st, 2nd, 3rd and reverse gears.

Fig. 5: Schematic drawing of 3 HP-22 automatic transmission and the power flow in the individual gears



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1981-07-13 bl/ic

CITROEN

Att.: hr. servicechef Kurt Mejlgaard

Vi har modtaget Deres brev af 09.06.81 omh. olietype BP Autran GM-MP og har i den forbindelse forespurgt på fabriken, om denne olietype må anvendes til ZF's automatgear type 3 HP 22, som anvendes i Citroen CX 2400.

Vi har nu modtaget fabriken's svar, som er som følger:

Den af BP tilbudte olie må ikke anvendes.

Fabriken henviser til smøreskema TE-ML 11, som vedlægges.

Med venlig hilsen
ZF DANMARK ApS

Bjarne Linnet
Bjarne Linnet



für ZF-AUTOMATGETRIEBE	3 HP-12
	3 HP-20
	3 HP-22
	4 HP-22

Zugelassen sind nur die auf der Rückseite dieses Blattes benannten Produkte.

(Bitte D-Nummer beachten!)

Für Nachfüllungen und Ölwechsel können alle Sorten dieser Liste verwendet werden.

Diese Sorten sind auch für die Erstbefüllung von Reparatur- und Ersatzgetrieben zugelassen.

Die ATF-Sorten dieser Liste sind miteinander mischbar.

Hinweise für Schmierstofflieferanten: Änderungen der Markenbezeichnungen, der Zusammensetzung und der Herkunft der freigegebenen Dexron-Sorten sind uns unverzüglich zu melden.

Vorliegende Ausgabe wird am 31.12.1983 ungültig.
Bitte fordern Sie im Januar 1984 die neue Ausgabe bei der ZF Getriebe GmbH, Saarbrücken, Abt. MK, oder bei der nächsten ZF-Kundendienststelle an!

AGIP AMPOL, Sydney/AUS ANTAR, Paris/F Aral, Bochum ASEOL, Bern/CH Autol, Hannover Avia	AGIP DEXRON II D-21 103 Ampol ATF Type DXR II D-20353 ANTAR DEXRON II D-20 600 Aral Getriebeöl ATF 22 D-20 749 ASEOL DEXRON II D 16-712 D-20 137 Autol-Dexron-D-20 383 AVIA FLUID ATF 77 DEXRON D-20 760	LABO, Nanterre/F MARTIN, Nürnberg Merk, Landshut Mobil Oil Morris, Shrewsbury/GB Motul, Aubervilliers/F	DEXRON II D-20 923 GIROMATIC DEXRON C/D-20383 Deltinol-Getriebeöl ATF Dexron D-20383 Mobil ATF 220 D-20 104 Golden Film Dexron II D-20 807 MOTUL DEXRON II D-21 159
BayWa, München Beverol, Beverwijk/NL Bösche & Bödeker, Bremen BP BUCHER, Langenthal/CH	BayWa ATF, DEXRON-D 20 739 Beverol Dexron II D-20 727 Turbo-Getriebeöl ATF Dexron D-20 383 BP Autran DX II D-20 335 MOTOREX ATF DEXRON II D-21 121	Neuling, Berlin OEL HANSA, Hamburg ÖMV, Wien/A	PN-FLUID-Getriebeöl Dexron II D-20 137 HANSA DEXRON D-20 739 ÖMV-AUSTROMATIC DEXRON II- D-20 768 OPALFLUID TA/D-20 728 Orvematic D-20 725
Caltex CASTROL CHEVRON	Texamatic Fluid Dexron II D-20 139 D-20 329, D-20 576 CASTROL TQ DEXRON II D-20 180, D-21 130, D-20 366, D-20 354, D-20 182, D-20 185, D-20 583 Chevron Automatic Transmission Fluid D-20 824	OPAL, Nanterre/F ORVEMA, Maarssen/NL PENNASOL, Lehrte PENNZOIL, Houston/USA Polaroil, Issoudon/F Prinz-Schulte, Frechen	OPALFLUID TA/D-20 728 Orvematic D-20 725 Pennasol Fluid Getriebeöl Dexron D-20 112 Pennzoil Hydra-Flo D-20 122 Polaf fluid Dexron D-20 356 AERO-LINE Dexron D-20 101
DELUXOL, Rotterdam/NL Deutzer Öl KG, Köln DUCKHAM, West Wickham/GB ELAN, Wien/A ELF Eller-Montan, Duisburg ESA, Burgdorf/CH Esso	DEXRON II-D-20 726 Dexron II D-21 158 DUCKHAMS FLEETMATIC CD-20 801 ELAN Austromatic Dexron II D-20 168 ELFMATIC G2 D-20 211 ELLMO-Fluid Dexron D-20 112 ESA DEXRON ATF D-20 356 ESSO AUTOMATIC TRANSMISSION FLUID DEXRON D-21 065	Raiffeisen, Hannover Sauerstoffwerk, Münster Schindler, Hamburg Shell Shell-Handel, Hamburg SOFRA, Paris/F SUN OIL	HG RENOFUID DEXRON D-20 739 WESTFALEN-Getriebeflüssigkeit ATF Dexron D-20 383 FRONTOL GETRIEBEOEL DXS DEXRON C/D-20 383 Shell Dexron II D-20 137 Mac Dexron II – D-20 137 HAFA TRANSMATIC B/D II-20 781 SUNMATIC 149 D-20 101
FANAL, Mülheim Fiat, Torino/I FINA FINKE, Bremen FUCHS, Mannheim	FANAL Dexron II D-20 383 Tutela GI/A D-20 782 FINA DEXRON II D-20 668 Aviaticon ATF/DEXRON D-20 112 RENOFLUID DEXRON D-20 739	TEXACO Total trek, Johannesburg/ZA	Texaco Texamatic Fluid 9226 D-20 112 Lastona Fluid II D-20 112 TOTAL DEXRON D-20 356 TREK DEXRON II D-20 530
Gulf Haberland, Dollbergen HESSOL, Bad Vilbel HGK, Düsseldorf Homburg, Wuppertal Hürlimann, Wädenswil/CH HUILES RENAULT, Venissieux/F	Gulf ATF Dexron II D-20111 Automatic Transmission Fluid Dexron D-20 112 HESSOL Dexron D-20 112 SVG Getriebefluid ATF D-20 790 HOMBERG-Getriebe-Fluid D-20383 ROLLSYNOL ATF Dexron II D-20101 RENAULT DIESEL DEXTRON D-20211	UNIL International Valvoline VEEDOL International Voitländer, Kronach WCG, Münster Wenzel & Weidmann, Eschweiler WEVAG, Bocholt	UNIL MATIC DEXRON II D-20 112 VALVOLINE VALVOMATIC ATF Type Dexron II D-20 739 VEEDOL ATF DEXRON II D-20 816, D-20 366, D-20 808 ARGON-Flüssigkeitsgetriebeöl AFT Dexron D-20 383
ICPA, Dordrecht/NL Käppler, Stuttgart Kompressol, Köln	OK – ATF-Dexron D-20 790 Selectol Fluid Getriebeöl Dexron D-20 112 KOMPRESSOL-Fluid-Matic D 52 – D 20 739	Wintershall, Düsseldorf YACCO, Caudebec/F	OK Getriebeöl ATF Dexron D 20 739 UK-Fluid II D-20 137 WEVAG Automatic Getr. Oel ATF Dexron D-20 383 Violin ATF Dexron D-20 383 YACCO ATF Type II D-20 806



Druckflüssigkeiten für hydrostatische Antriebe in geschlossenem Kreislauf

(Bei hydrostatischen Lenkungen bitte Schmierstoffliste TE-ML 09 beachten!)

Für Antriebe mit gemeinsamem Ölhaushalt des mechanischen Getriebes mit der Hydrostatik bitten wir um Rückfrage bei ZF, Abt. TE-WL.

Die nachstehend empfohlenen Druckflüssigkeiten sind für den Einsatz in hydrostatischen Antrieben bestimmt.

- 1. Hydrauliköle HLP nach DIN 51525 (diese Norm ist in Überarbeitung und wird DIN 51524 zugeordnet)
2. HD-Motorenöle nach MIL-L-2104 B, 2104 C, 46152 bzw. API-CC, CD, SC, SD, SE
3. Automatic Transmission Fluids (ATF)
4. Andere Medien wie Universal- oder Mehrzwecktraktorenöle, HL-Öle, Mehrbereichsöle, schwer entflammbare Flüssigkeiten und Syntheseöle nur auf Anfrage.

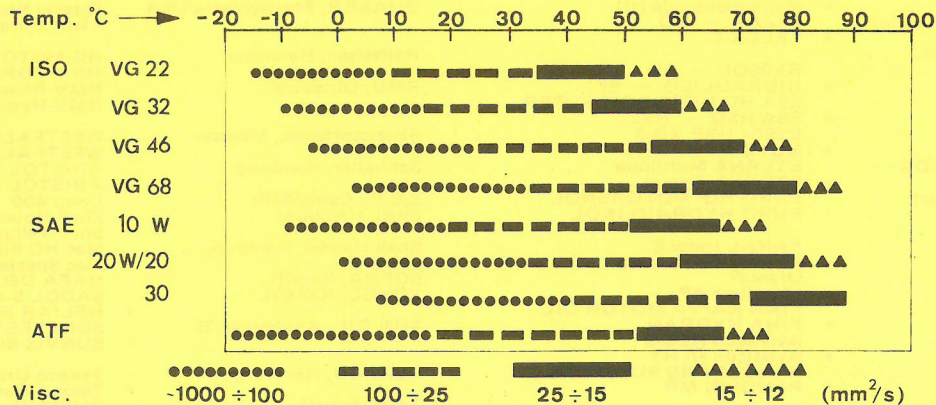
Zulässige Viskositätsgrenzen:

Die Betriebsviskosität darf 12 mm²/s nicht unterschreiten, sie soll im Bereich von 12 bis 100 mm²/s liegen (besten Wirkungsbereich 15 bis 25 mm²/s).

Die Startviskosität darf 1 000 mm²/s nicht überschreiten.

Die Betriebstemperatur soll nicht höher als ca. 80 °C sein (gemessen am Leckölaustritt der Pumpe bzw. des Motors). Gegebenenfalls ist ein Wärmetauscher zwischenzuschalten!

Die nachstehende Skizze gibt den ungefähren Anwendungsbereich der nach 1. bis 3. zulässigen Druckflüssigkeiten an:



Auf der Rückseite dieses Blattes sind verwendbare HD-Motorenöle aufgeführt. Andere Motorenöle können eingesetzt werden, wenn die unter 2. genannten Bedingungen erfüllt sind.

Die mit dem Vorzeichen * gekennzeichneten Produkte sind HLP-Öle. Diese Markenöle können in der geeigneten Viskositätsgruppe zur Anwendung kommen.

Hinweis für Schmierstofflieferanten: Änderungen in der Zusammensetzung der freigegebenen Produkte oder der Markenbezeichnung sowie Qualitätsunterschiede im In- und Ausland sind uns unverzüglich zu melden.

Vorliegende Ausgabe wird am 31.12.1982 ungültig. Bitte fordern Sie im Januar 1983 die neue Ausgabe bei der Zahnradfabrik Passau GmbH, Abt. TSID oder bei der nächsten Kundendienststelle an.

