HÄGGLUNDS

HYDRAULIC WHEEL HUB MOTORS

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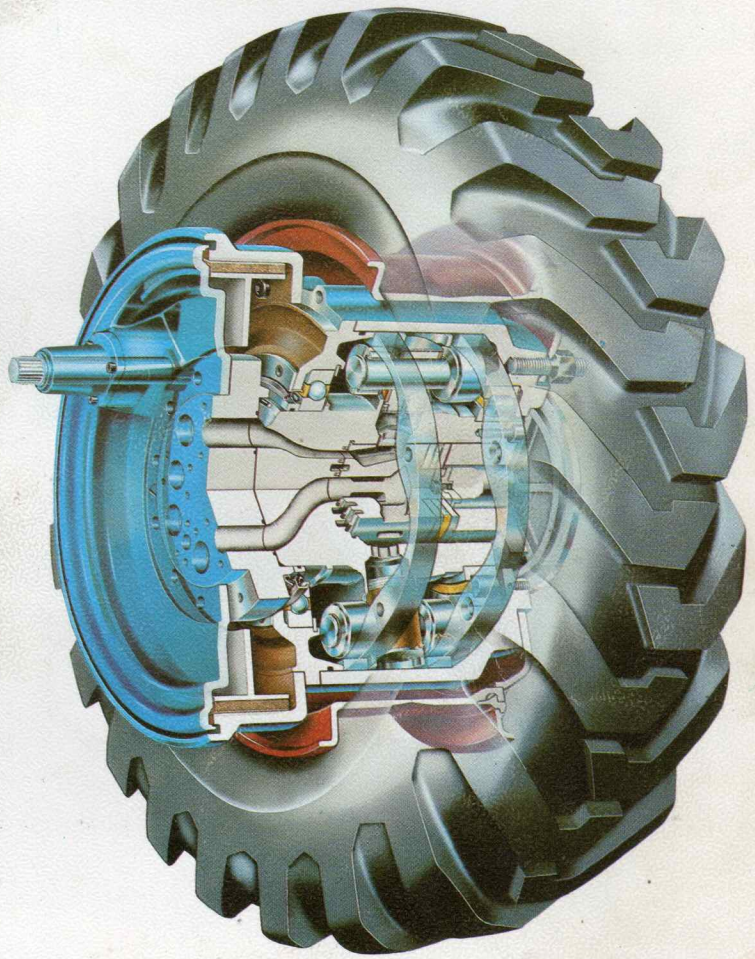
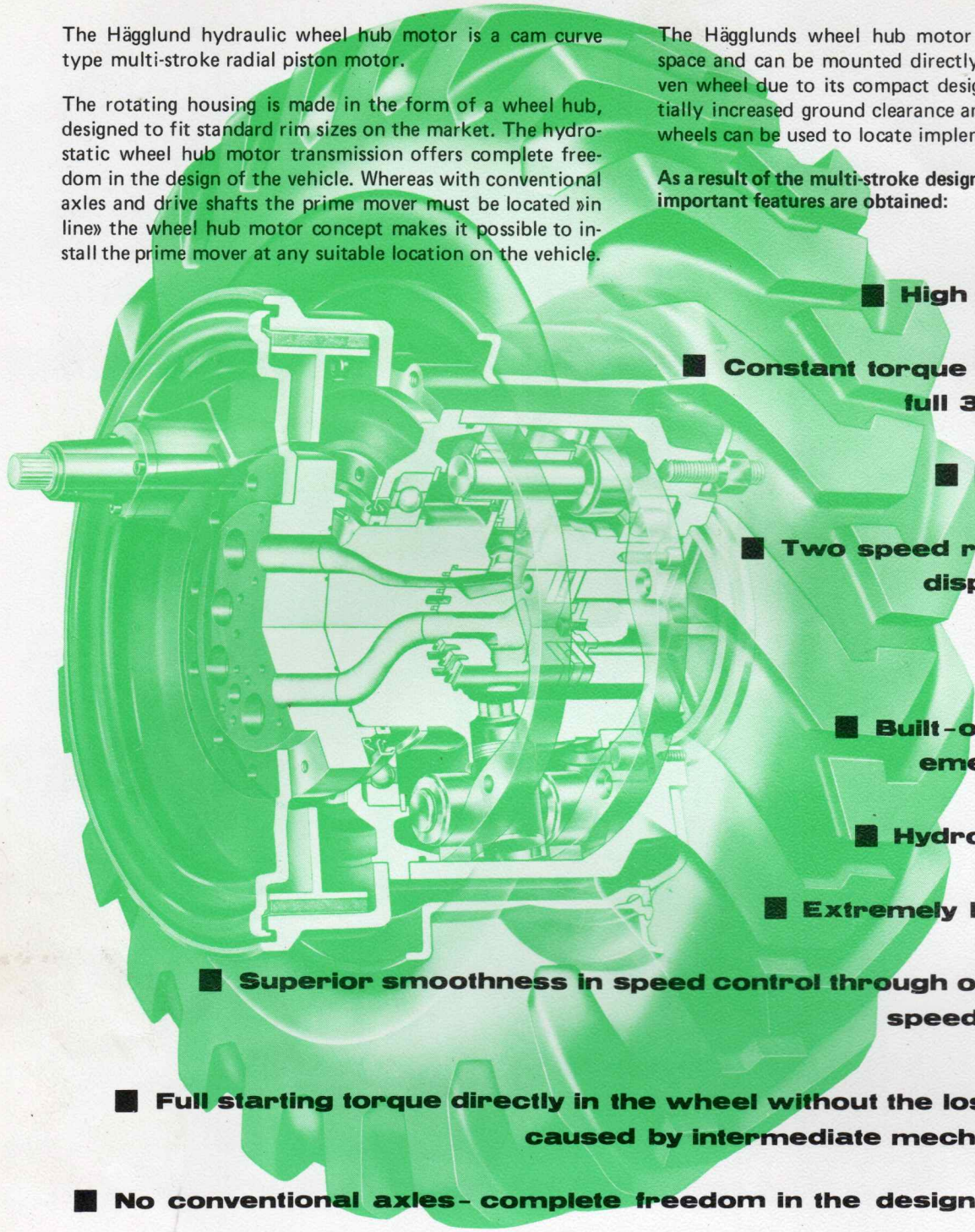


The Hägglund hydraulic wheel hub motor is a cam curve type multi-stroke radial piston motor.

The rotating housing is made in the form of a wheel hub, designed to fit standard rim sizes on the market. The hydrostatic wheel hub motor transmission offers complete freedom in the design of the vehicle. Whereas with conventional axles and drive shafts the prime mover must be located »in line» the wheel hub motor concept makes it possible to install the prime mover at any suitable location on the vehicle.

The Hägglunds wheel hub motor requires a minimum of space and can be mounted directly into the rim of the driven wheel due to its compact design. The result is substantially increased ground clearance and the space between the wheels can be used to locate implements etc.

As a result of the multi-stroke design principle, the following important features are obtained:



- **High external loads**
- **Constant torque throughout the full 360° of rotation**
- **Free-wheeling**
- **Two speed ranges through displacement shift**
- **Reversible**
- **Built-on parking and emergency brake**
- **Hydrostatic braking**
- **Extremely low noice level**
- **Superior smoothness in speed control through outstanding low speed performance**
- **Full starting torque directly in the wheel without the loss in efficiency caused by intermediate mechanical gearing**
- **No conventional axles - complete freedom in the design of the vehicle**

INTRODUCTION

TECHNICAL DATA

Motor type	FULL DISPLACEMENT				Max. peak pressure p bar	Weight kg		Moment of inertia	
	Displacement V_i		Ideal torque m_v	Max speed n		without brake	with brake		
	lit/rev	in^3/rev	Nm/bar	rev/min				kgm^2	$lbf{\cdot}ft{\cdot}s^2$
0355	0,43	26,2	6,8	300	350	93	111	0,83	0,60
0555	0,57	34,7	9,1	400	350	98	116	0,83	0,60
1155	0,85	52,0	13,6	300	350	98	116	0,83	0,60
3460	1,70	103,5	27,0	200	350	280	355	4,54	3,28
3160	3,40 ★	207,0 ★	54,0 ★	200	350	290	365	4,54	3,28

★ Half displacement: Displacement – 1,7 lit/rev (104 in^3/rev); Ideal torque – 27 Nm/bar

CONVERSION FACTORS

1 lit	=	0,220 Imp. gall.
1 lit	=	0,264 US gall
10 Nm	=	1,020 kpm
10 Nm	=	7,376 lbf·ft
1 bar	=	14,504 psi
1 bar	=	1,020 at
1 at	=	1 kp/cm^2
1 kg	=	2,205 lbs

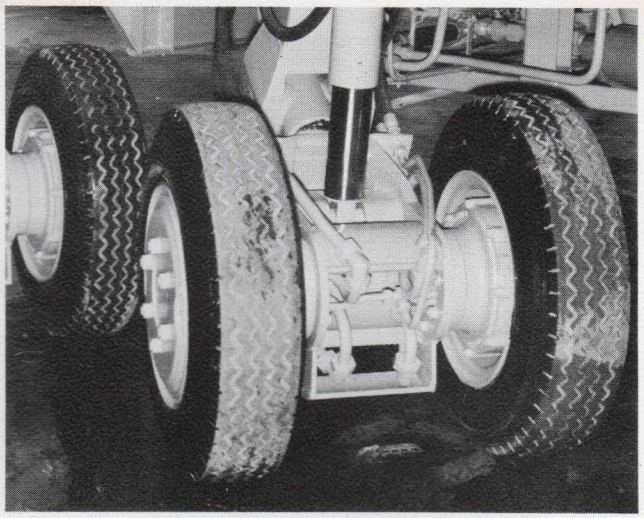
External loads on the motor must be kept within certain limits in order to ensure trouble-free operation. We assume an estimated equivalent maximum radial load F_R:

$$F_R = F_{Rstat}\ (1 + \alpha) + k \cdot r \cdot F_a$$

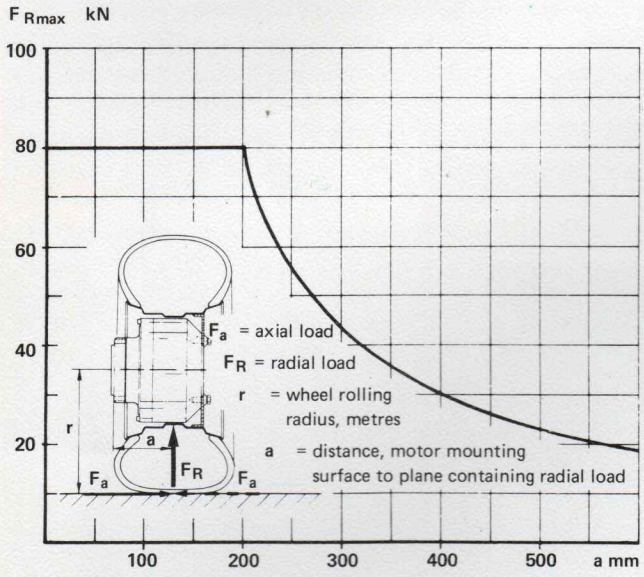
F_R is composed of two forces: one purely radial consisting of the static load plus a dynamic contribution represented by the »shock factor» α and one radial force consisting of the purely axial load multiplied by the »thrust factor» k and the wheel radius, r.

For motor Type 0355, 0555 and 1155 the »thrust factor» is 5.7 and for Type 3160 and 3460 it is 4.0.

The resultant equivalent radial load, must be contained within the limits given by the Diagrams below.

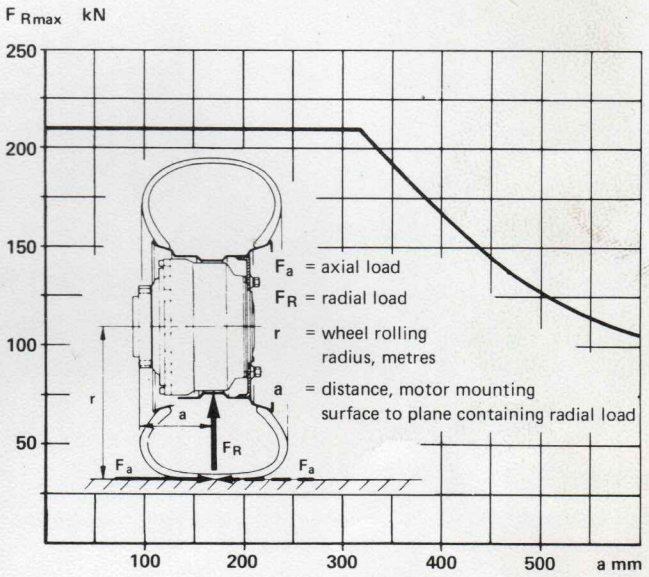


0355 0555 1155



Max. permissible F_a = 30 kN

3460 3160



Max. permissible F_a = 75 kN

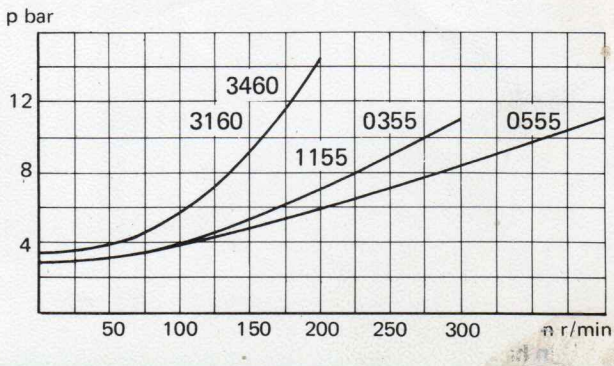
EXTERNAL LOADS

FEED PRESSURE

The feed pressure requirements are shown in the diagram. Feed pressure is required to provide adequate control pressure for the pump and sufficient pressure in the low pressure line of the closed loop circuit to maintain continuous positive contact between the cam and the cam follower bearings.

The fluid supplied to the closed loop circuit by the feed pump shall be filtered by a 10 micron nominal rated filter.

The motor case pressure must not exceed 3 bars.



Manoeuverability

The high mechanical efficiency of the Hägglund wheel hub motor in combination with the control simplicity of the hydrostatic drive system offers extremely good manoeuverability.

For fork lift trucks it is very important, that the drive and speed control is simple and easy to handle, so that the driver can concentrate on the load handling.

Free space between the wheels

For many types of vehicles the possibility of utilizing the free space between the wheels for different types of implements is an important requirement. One typical example is agricultural vehicles of different types.

Hägglunds wheel hub motors are installed directly into the rims of the driven wheels, thus providing a free space between the wheels.

For other types of vehicles, e.g. mining vehicles, the height of the machine must be limited, In this case the free space between the wheels can be utilized for accomodation of the prime mover. This way extremely low vehicles can be designed.

Low noise level

During the last few years regulations regarding maximum noise level have been introduced in many countries. Max. permissible noise levels will be further decreased in the near future.

The combustion engine with the built-on hydraulic pump can normally be loacted in such way, that it can be easily insulated. For the secondary part of the transmission the insulation is normally very complicated.

The high frequency »hydraulic noise» typical for the high-speed hydraulic units is not produced by the Hägglund wheel hub motors, that run at low speed. In addition, the typical noise from gear boxes, drive shafts and other transmission components is eliminated through the use of the wheel hub motors.

Also in comparison with a torque converter transmission the hydrostatic transmission offers advantages as far as low noise level is concerned. With the torque converter the diesel engine must run at very high rpm in order that the torque converter can transmit the full tractive effort. The hydrostatic transmission will produce full tractive effort also at a comparatively low diesel engine speed.

Driven and steered wheels with extremely large steering angles

BIG VEHICLES REQUIRE SMALL SPACE!

This somewhat contradictory statement has now become a reality through the use of hydraulic wheel hub motors. The lack of mechanical transmission components permits a steering angle of more than $\pm$ 90° for the driven and steered wheels. The moving platform, designed for transportation of payloads up to 200 tons, has a manoeuverability similar to a hovercraft.

Complete range of valves

Included in the Hägglund mobile line of equipment is a complete range of motor valves. By means of these valves the motors can be free-wheeled, which means that they rotate freely on their main bearings.

The valves can also be used for changing the displacement of the motors in ratio 1:2, thus providing two speed ranges for a given oil flow.

Through combination of the different valves a wide speed range can be obtained with a limited oil flow.

The four-wheel drive mining dumper has a hydraulic system based upon these valves, which ensures smooth and flexible speed control of the vehicle.

Free-wheeling

Auxiliary drives using wheel motors is an interesting application in vehicles operating both on-road and off-road. The photo below shows such a vehicle. Two wheel motors are installed in the front wheels of the cable laying trailer. When the vehicle is driven on-road the wheel motors are free-wheeled, which means, that they rotate freely on their main bearings similar to a conventional wheel on its bearings.

When driving off-road, the motors are engaged, which provides a supplementary tractive effort. Dis- and re-engagement of the motors is accomplished by means of a Hägglund valve mounted directly onto the connecting flange of the motor.

Also the drive rolls for the cable drum are driven by two wheel motors.

High external loads

The rugged design of the Hägglund motor with the heavy duty main bearings completely hydraulically balanced permits an external loading capacity equivalent to the toughest heavy duty tyres on the market.

High output horse-power

The output corner horse-power of the motor is very high. The trencher, also called the »Roc-saw», has a 1000 Hp diesel engine installed for two 3160 wheel hub motors, that drive the chain. The average horse power output is only slightly lower than the max. horse power output.

High ground clearance and individual wheel suspension

For vehicles working in rough terrain a high ground clearance is of utmost importance. Conventional axles have a limitation in this respect, since the lowest point of the axle is located far below the wheel centre. The use of wheel motors eliminates the axles, which increases the ground clearance substantially.

Up to now heavy off-road vehicles have not been equipped with wheel suspension. Individual wheel drive by means of wheel hub motors eliminates the need of axles and drive shafts, which permits separate suspension of each wheel, for instance on a pivoting arm. Experience from test vehicles has shown, that this makes driving much more comfortable for the operator and also that the speed in rough terrain can be increased considerably.

The Hägglund wheel motors are designed to operate on conventional petroleum base hydraulic oil. Normal oils for combustion engines can also be used. In that case we recommend oil type 10W30. Excessive operating temperatures sharply reduce the service life of oil and rubber seals.

The temperature should be kept below 60°C (140 F), if at all possible, since the rate of oxidation of the oil increases rapidly above this temperature.

The hydraulic oil can be chosen in consultation with an oil supplier and should meet the following requirements:

Recommended viscosity at operating temperature min 20 cSt.

Min. permissible viscosity 10 cSt.

Max. continuous operating temperature 70°C (158 F).

Max. permissible operating temperature 85°C (185 F).

The oil should contain anti-wear additives.

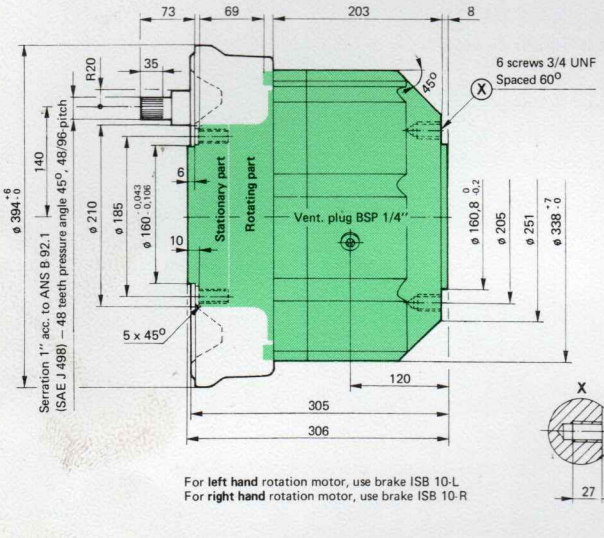
Whenever in doubt contact Hägglunds or the local Hägglund representative.

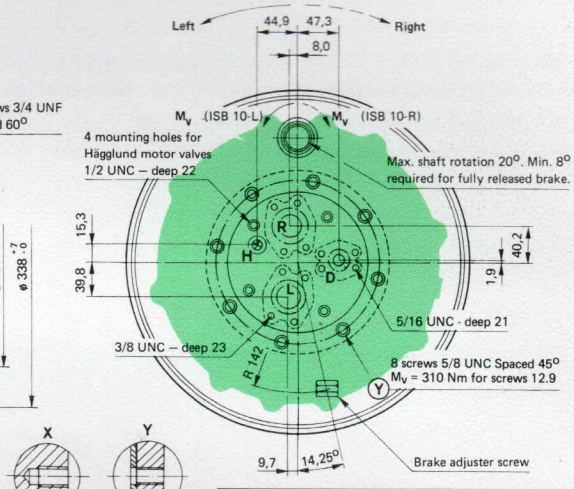
OIL RECOMMENDATIONS

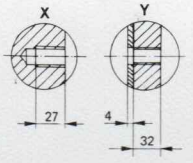
DIMENSIONS

0355 0555 1155

Max. braking torque 6,2 kNm at M_V = 180 Nm







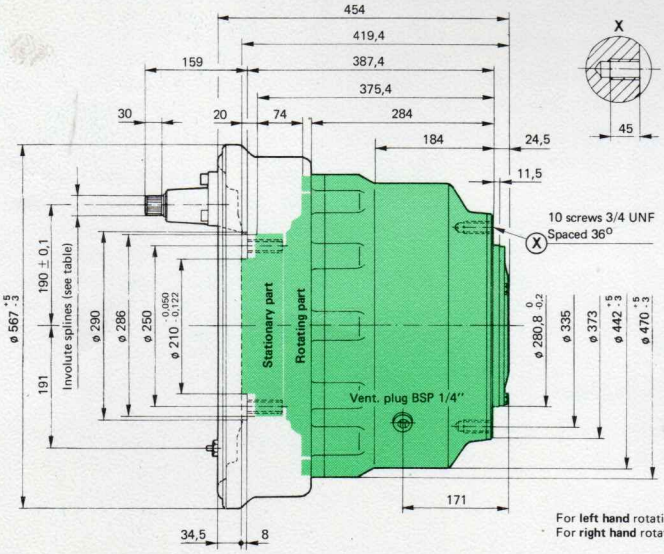
For **left hand** rotation motor, use brake ISB 10-L
For **right hand** rotation motor, use brake ISB 10-R

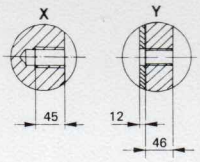
Connection	Function	Type of connector
L, R	Main connections	1" SAE flange J518
D	Drain connection	1/2" SAE flange J518
H★	Drain connection	BSP 1/4" - deep 17

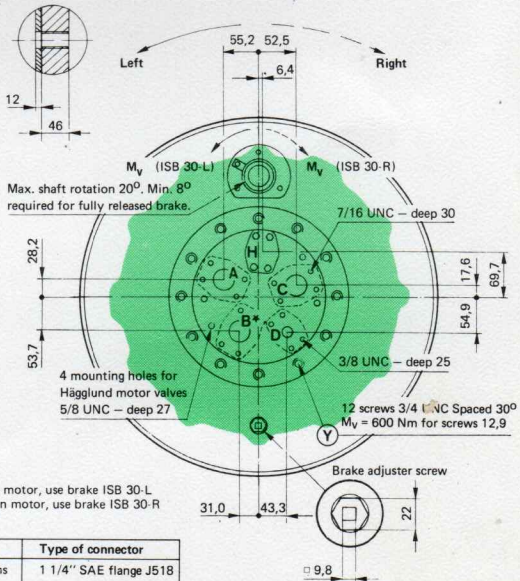
★ Normally closed on delivery. To be used as inlet port when flushing the motor case.

3160 3460

Max. braking torque 20 kNm at M_V = 630 Nm







For **left hand** rotation motor, use brake ISB 30-L
For **right hand** rotation motor, use brake ISB 30-R

Involute splines			
Modul	0,5	Pitch diameter	29,5
Number of teeth	59	Dedendum line diameter	28,8 −0,17 −0,08
Pressure angle	45°	Pitch	1,571
Major diameter	29,85 +0,05 −0,1		

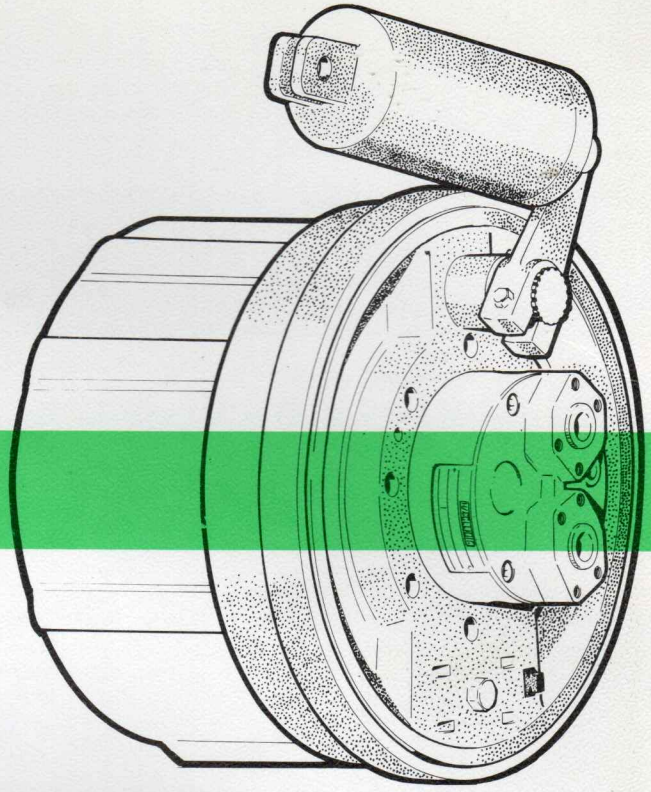
Connection	Function	Type of connector
A, C	Main connections	1 1/4" SAE flange J518
B★	Main connection	1 1/4" SAE flange J518
D	Drain connection	3/4" SAE flange J518
H★★	Drain connection	3/4" SAE flange J518

★ Only motor 3160
★★ Normally fitted with a blind flange when delivered. To be used as inlet port when flushing the motor case.

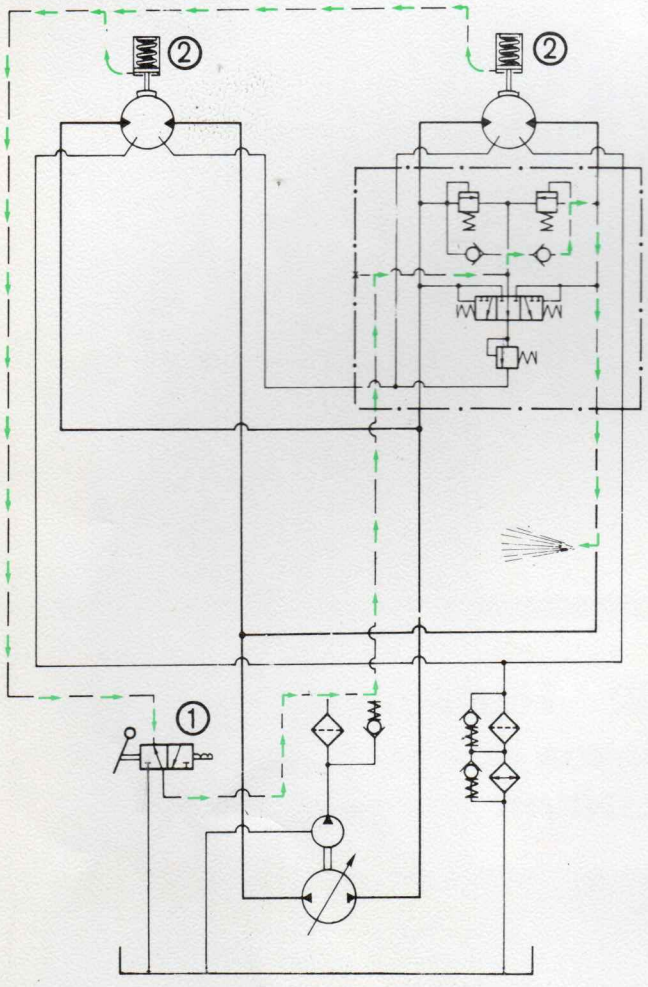
BRAKE SYSTEM

The braking ability inherent in the hydrostatic transmission is normally sufficient for dynamic braking. In addition a parking and emergency brake system is required.

The Hägglund brake system, consisting of a machanically operated internal shoe brake, brake lever and spring-on hydraulic cylinder, provides a reliable parking and emergency brake system.



ACCESSORIES

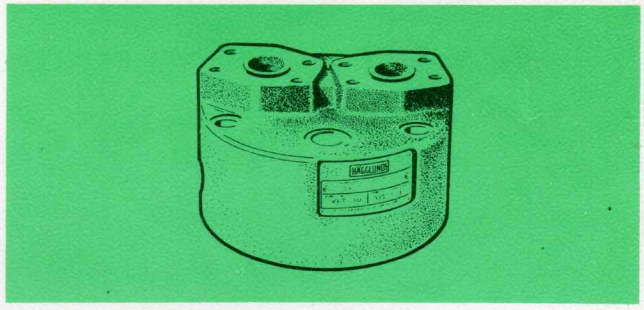


The function of the braking system is shown in the circuit above. The brake is operated by the charge pressure via the brake operating valve pos 1 and the hydraulic cylinders pos 2. When the vehicle is parked, the cylinders are drained through the brake operating valve to tank and the brake is actuated. In case a hose in the main line should burst, the automatic emergency brake comes on. When the hose bursts, the charge pressure drops, the brake cylinder is drained and the brake comes on automatically, irrespective of whether the operator actuates the brake operating valve or not. Although the brake system is mainly intended as a parking and emergency brake system, it can also be used for dynamic braking if required.

VALVES

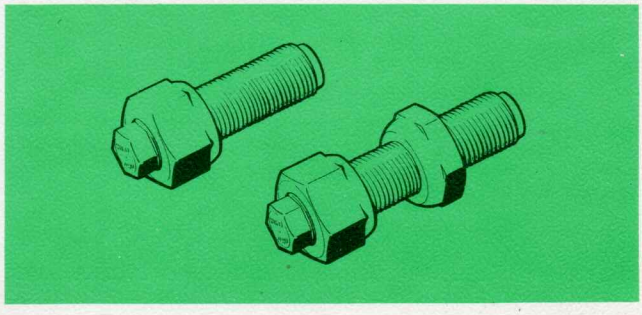
The introduction of the Hägglund complete line of wheel motor valves has substantially simplified the layout of hydrostatic wheel motor transmissions. The valves that mount directly on to the wheel motors provide all necessary functions for a mobile transmission system. By locating the valves directly on to the motors, all line mounted valves have been eliminated and the number of pipe couplings reduced to a minimum.

For detail information on the valves refer to our separate brochures and application manual.



WHEEL BOLTS

For the mounting of the rim on the wheel motor Hägglunds provide wheel bolts in different configurations, that will fit most of the standard rims on the market.



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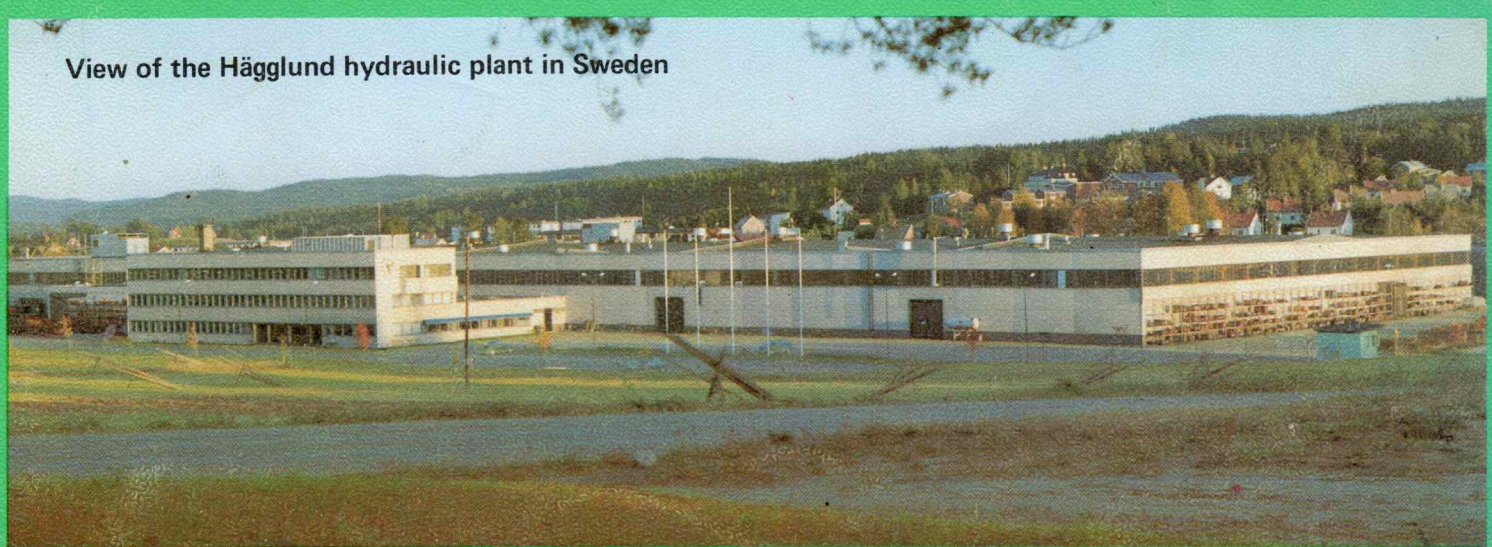

View of the Hägglund hydraulic plant in Sweden