



HYDRAULIC ENGINE STARTING SOLUTIONS



HYDRAULIC ENGINE STARTING SYSTEMS

Diesel engines are rightly seen as solid, dependable sources of energy, used in many situations where absolute reliability is critical. However, starting these compression ignition engines in less than ideal conditions has always been a challenge.

Electric starting is the popular choice, but has some serious limitations for more specialised application. For large engines an electric starter is impractical and for mobile applications (especially marine applications) the characteristics of starting batteries can be a big problem. Low temperatures increase the viscosity of the fluids in the engine and make it more difficult to turn over. Unfortunately these same conditions reduce the power available from the battery and reduce the cranking speed. Flattening the battery before the engine fires becomes a real possibility and until a more powerful battery is available the engine cannot be started.

A number of alternatives have been used over the years to ensure that the engine fires. Some engines were designed with a spark ignition system and

actually started on petrol - only switching to diesel when warmed through. Other methods were more explosive, using either blank shotgun cartridges or even highly volatile 35mm film to kick the engine into life.

The main alternatives to electric starting are air, hydraulic and spring starting. Air starting is preferred over electric starting for large engines and is very cost-effective wherever a reliable source of compressed air is available. Spring starters are cost-effective but effectively limited to small engines as they can only store a very limited amount of energy. This also compromises their ability in cold conditions and to make the most of the stored energy they must engage at full force. Spring Starter are not applicable for engines with electronic injection.

HUEGLI TECH has been designing and supplying hydraulic starting systems for over 50 years which avoid all of the drawbacks of other. A well-designed hydraulic system will accelerate an engine to a higher speed than a standard electric, air or spring system. This is im-

portant as it is the speed of compression of the air in the cylinder that causes its temperature rise to the point where it will ignite the injected diesel fuel. The use of HUEGLI TECH's own Soft Engagement Valve ensures that the full torque is not applied until the pinion is fully engaged with the ring gear, thereby drastically reducing the shock of engagement (common to spring starters and the old explosive types) and which can shorten the service life of engine and starter alike.

The energy storage medium for a hydraulic system uses a fixed charge of compressed nitrogen gas in one compartment of a hydraulic accumulator. The total cranking time can be increased simply by increasing the number and/or size of the accumulators. All the systems supplied by HUEGLI TECH include a fixed displacement hand-pump enabling the accumulators to be re-charged by muscle power and therefore providing unlimited cranking cycles.

Virtually unlimited applications e.g.

- Offshore - Generator sets, fire pumps, cranes, supply vessels, Compressors
- Marine - Propulsion engines, bow thrusters, lifeboats
- Mining - Locomotives, tractors, loaders, transporters
- Mechanical Handling/Construction - lift trucks, sideloaders, dumptrucks, tractors, graders
- Stand-by Power Plant for hospitals, factories, computer installations
- Fire Protection Systems

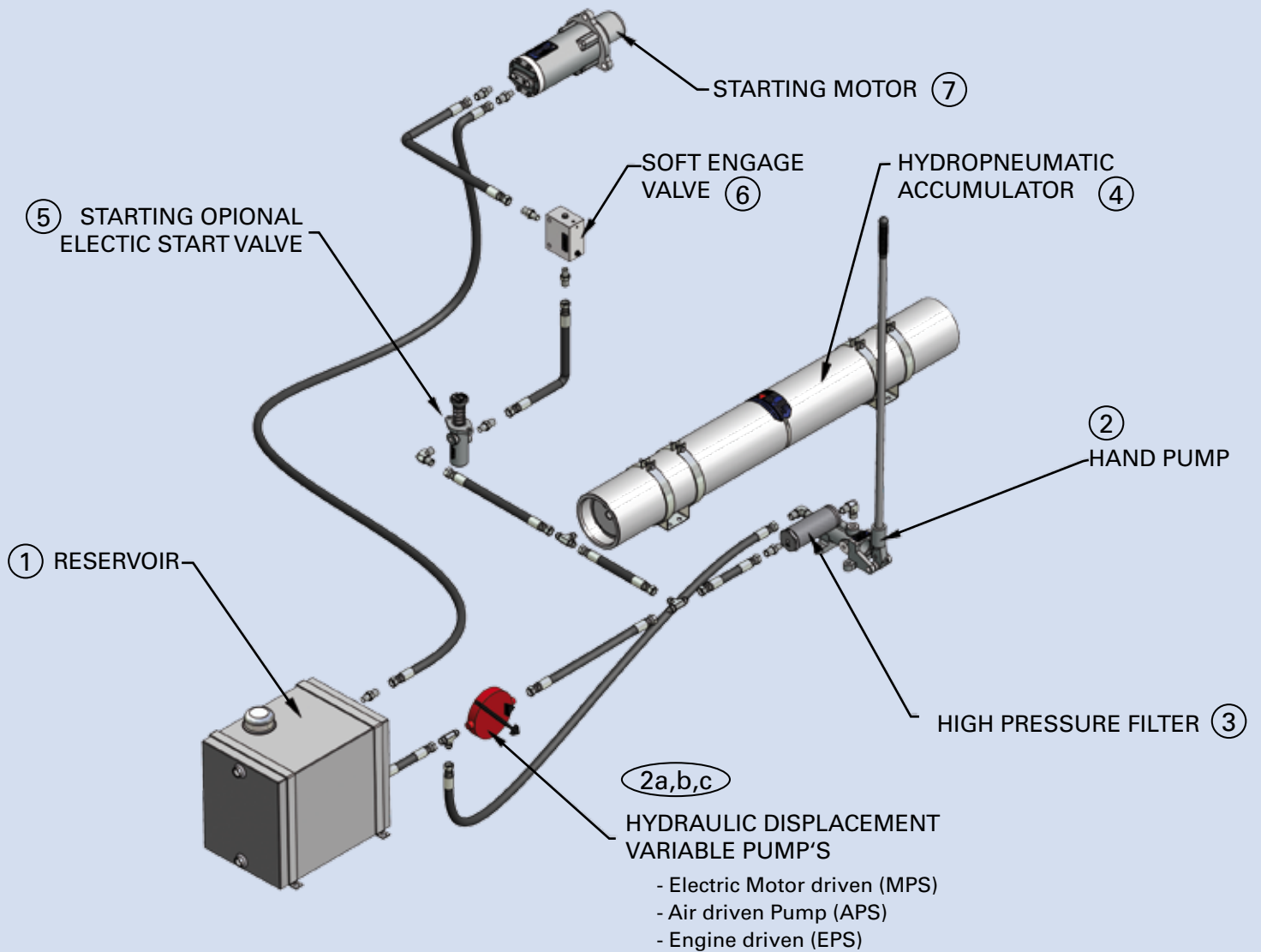




The Benefits

- The Hydraulic Starter, with over 90% efficiency, turns the engine faster.
Result: Higher combustion temperature. Reliable ignition, positive start
- Capable of starting an engine without external power
- Black start capability
- At -40°C the Hydraulic Starter provides the same high torque as at normal temperature
- The Hydraulic Starter can be equipped with a spark free pinion - ideal for fire hazard areas
- Each Hydraulic System incorporates a Hand pump for manual recharging.
Starting is always possible, anywhere, anytime
- Hydraulic Starting Systems are approved by classification societies. Ideal for marine applications
- Hydraulic Starting Systems are virtually maintenance free, last the life of the engine, save costs!
- Hydraulic Starting Systems can be tailored for a particular application with engine prelube
- Hydraulic System allows incremental rotation of the engine. Very convenient for service purposes

DESIGN & OPERATING PRINCIPLE



From a reservoir (1), or from an existing hydraulic system, hydraulic fluid is pumped, either manually (2), or by some auxiliary pump (2a,b,c), into a virtually maintenance-free accumulator (4). In it is a free floating piston, which is under nitrogen gas pressure, pre-loaded to c.100 bar.

Once the accumulator is sufficiently charged, the pump is stopped. To start the engine a leak proof starter valve (5) is opened, either manually, electrically or pneumatically.

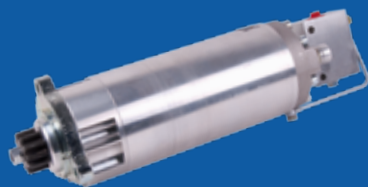
A special soft engagement valve (6) then releases first only a small amount pressurised oil into the starter (7) in order to engage the starter pinion softly into the engine ring gear. This also avoids mechanical stress on the ring gear and the starter.

Then, the increasing counter pressure opens the soft engagement valve fully, accelerating the engine to firing speed.



THE INDIVIDUAL HYDRAULIC COMPONENTS

Starting Motor



HuegliTech and Hydrotor Starter

The Technology that turns engine faster. With over 90% efficiency Hydrotors cranks any engine size, from very small up to over 70litres displacement. With various flanges, configurations pre-engage and soft cycle inertia starters, with a overhung pinion version, the Hydraulic starter can be fitted on any engine.

If no ring gear is available, starting over a PTO is also possible.

Hydraulic Starters combine the high efficiency of the axial piston motor concept which provides high torque at any temperature or environment.

Together with the soft engagement Valve Hydraulic starting guaranties a minimum wear of the engine ring gear and the pinion.

THE INDIVIDUAL HYDRAULIC COMPONENTS

Accumulators



An accumulator is a pressure vessel in which fluid is stored. Typically, an accumulator contains a compressible gas, a separator (i.e. piston, bladder diaphragm, etc.), and an incompressible hydraulic fluid. The compressible gas behaves much like a spring, which allows energy to be stored and dissipated, while the separator transfers these changes in energy and volume to the hydraulic fluid.

Marine Classifications



Design according



Additional Recharging Options



The hand pump is a manually operated pump used to „recharge“ accumulators. This pump can provide an unlimited number of starting attempts, which can be critical for emergency starting applications.

Starting Valves



Starting Valves to start the system are available in different variants.

Pedal Valve

This is a simple on/off valve, activated by foot, or by an external lever arrangement and is suitable for starting motors CMO, CMA, HCA. Required opening force is 29 kg.

Cable Operated Mechanical Valve

This level operated mechanical valve has a higher flow rate, and is suitable for all starting motors. It can be remotely activated by a bowden cable.

Solenoid Operated Valve

This solenoid operated valve is also suitable for all starting motors. It accepts various DC, and also AC voltages. Ex-proof versions are available. It incorporates a manual override, in case of power failure.

Unique Soft Engagement Valve



It is fitted between starting valves and starting motor. It guarantees smooth preengagement of the starter pinion into the ring gear and prevents shock and stress on mechanical parts. A vital contributor extending starter life.



TECHNICAL INFORMATION

Accumulator piston type

Housing materials	Steel
Piston material	Aluminium
Max. working pressure	207 bar
Proof pressure	848 bar
Nominal volumes in litres	1.9/ 1.8/ 5.7/ 11.4/ 19/ 28.5/ 38/ 47.5/ 57

Accumulators bladder type

Housing material	Steel
Bladder material	Nitrile rubber
Max. working pressure	210 bar
Proof Pressure	315 bar
Nominal volumes in litres	1/ 2.5/ 4/ 5/ 6.3/ 10/ 20/ 30/ 50

Starting motor

Max. working pressure	207 bar
Starts engines with displacement in ccl	CMA up to 9 litres CMA / HCA up to 18 litres CMD / HCD up to 41 litres CME up to 70 litres
Min. efficiency	92%
Housing materials	Aluminium, optional ductile iron

Hand Pump

Max. working pressure	207 bar
Housing material	Aluminium
Stroke	25.4 mm, dual acting
Output	20 cm ³ per cycle
Force required on handle at 207 bar	22 kg

COMPLETE POWERPACK OPTIONS SIMPLIFY INSTALLATION

Assembly Variation

Variation „A“

All components mounted on Reservoir.
 Accumulator(s) placed in engine frame.
 Size, and number of starting attempts can be customised.

Variation „B“

All components mounted on a Frame.
 Accumulator(s) included.
 Size can be adapted to customers requirements.

The version Variation “B” greatly simplifies the installation of a hydraulic starting system. It eliminates locating and piping the individual system components to the engine.

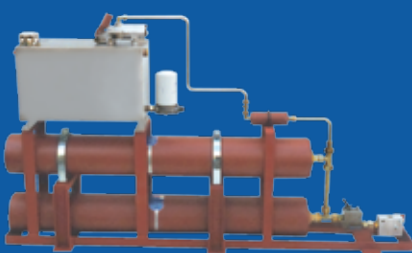
	Variation „B“	Variation „A“
Frame	x	x
Hydraulic Starter	x	x
Acumulator	x	
Hose kit	x	
RCO*	(x)	(x)

*RCO = Recharging Option

HPS - Handpump Starting System CPS - Compact Starting System



EPS - Engine driven pump supported recharging system



The small HPS / CPS from HUEGLI TECH is a convenient, space saving option capable of starting an engine without external power, even under harsh environmental conditions. The package is also designed to fit into the engine frame or genset frame.

Benefits:

- Use in emergencies and / or total power failure.
- Accumulator is recharged by handpump.

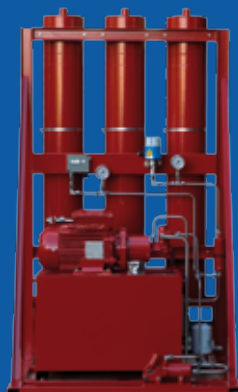
All HPS systems can be complemented with a special engine driven pump, either by belt or gear. Flanged versions are available. As soon as the engine runs, it starts to recharge the accumulator. This HYDROTOR pump incorporates an internal unloading valve, which switches the pump to idling mode, as soon as the max. adjusted pressure is reached. No more force is required for rotation. It will automatically cut in again, when the accumulator pressure falls below a certain value.



APS – Airmotor driven Pump supported recharging System



MPS – Electric Motor driven Pump supported recharging System



Suitable for locations where compressed air is available.

Stainless steel reservoir with additional airmotor recharging pump. Marine classification approved, on large V16 engines Complete skid with airmotor recharging pump for 3 x 6.5 seconds consecutive starting attempts.

Standard, or Ex-proof recharging Modules for remote automatic starting cycles.

Accumulator(s) fitted separately in engine frame. Note: Marine certification available on request.

Project: USAN



Application: Containerised Emergency Genset
Engine: MTU 16V4000
Solution: MPS-G-600A

This Hydraulic Starting System was designed to enable the Black Start of a containerised Genset. The System can provide up to 6 start attempts, each of 5 seconds duration, when the Accumulators are fully charged. Recharging of the Accumulators is done via an electrically-driven Recharging Pump. All electronic components are suitable for Atex zone 2 and usable in hazardous areas.

Stainless steel Reservoir (316L), pipes and fittings were supplied fully assembled.

Accumulators are supplied with Bureau Veritas pressure approval. All components are mounted on the reservoir. The system is specially painted to resist corrosion in the defined offshore environment. As with all Hydraulic Starting Systems from HUEGLI TECH include a hand-pump and manual starting valve and are, therefore, completely self-contained and independent of any outside power source.

Project: EHSY



Application: secondary Starting system
Engine: MTU V8 2000
Solution: HPS-C-30-B

This Starting System was designed to enable the black start of an emergency genset in a hospital.

The system provides 2 start attempts, each 3 seconds duration.

Recharging the Accumulators is via Hand Pump.

No special Pressure Approval.

All components mounted on a frame. The System was specially constructed to be fitted onto the engine frame and avoid taking any additional space in the confined engine room.



Project: APS Congo



Application: secondary Starting system
Engine: CAT 3406
Solution APS-B-200A-B

This Starting System was designed to enable the black start of a Marine Genset.

The system provides 6 start attempts, each 5 seconds duration. Recharging the Accumulators via an Air-driven recharging pump with a hand pump as back-up. Accumulators were supplied with ABS approval. All components are mounted on the reservoir. All pipes and fittings are stainless steel.

The system is specially painted to resist corrosion in the defined offshore environment.

The products described in this publication are subject to be revised or improved at any moment. Catalogue descriptions and details, such as technical and operational data, drawings, diagrams and instructions, etc., do not have any contractual value. In addition, products should be installed and used by qualified personnel and in compliance with the applicable regulations in force in order to avoid damages and safety hazards.



Innovation and Function

HUEGLI TECH is the leading manufacturer of hydraulic starting systems. With over 50 years of experience and large know-how, we supply Starting systems capable to start combustion engines in extreme environmental and weather conditions. Beside the standard applications, we also design customised Systems.

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