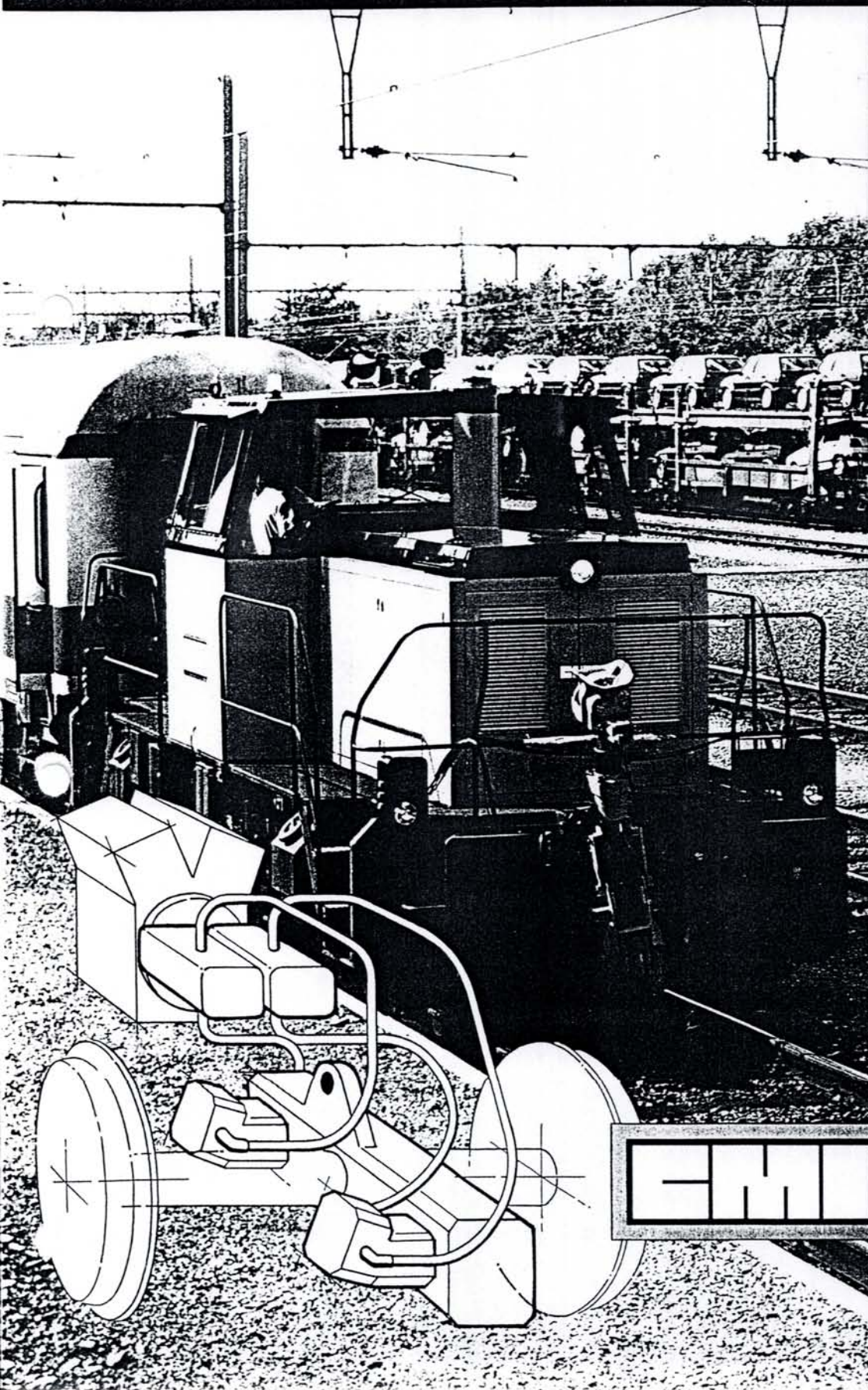


# THE CMI HYDROSTATIC LOCOMOTIVE



**CMI** COCKERILL  
MECHANICAL  
INDUSTRIES

CMI LOCOMOTIVES  
AND DIESEL ENGINES

# The hydrostatic transmission and its integrated electronic control and diagnosis system, key to major progress in rail shunting.

In addition to the assembling flexibility leading to an absolute free lay-out and allowing an enhanced modular and ergonomic concept, the hydrostatic transmission together with its integrated control and diagnosis system offers a general increase in the shunting locomotive main performances:

- The average efficiency of the hydrostatic transmission is 10 to 15 % higher than the efficiency of the hydrodynamic transmission.
- The locomotive speed is smoothly and accurately controlled from 0 km/h up to the maximum speed.

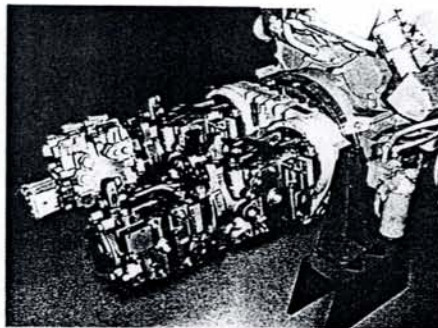
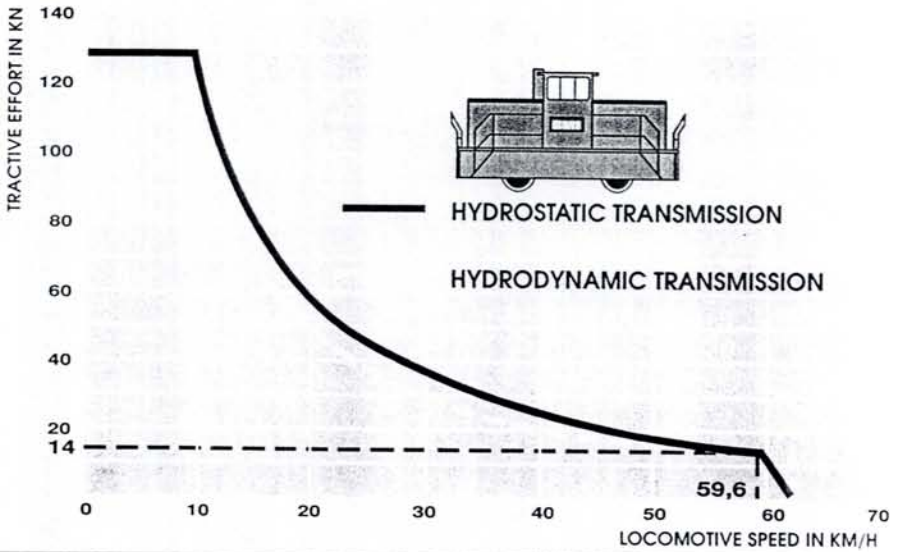
On the whole speed range, the electronic control continuously adapts the power delivered by the Diesel engine to the exact speed, which avoids unnecessary energy consumption. That feature also allows a decrease of the minimum continuous speed down to 0 km/h.

- The braking system, by an additional dynamic braking.
- The smooth and comfortable driving, and especially the motion reversal without inverter or clutch.

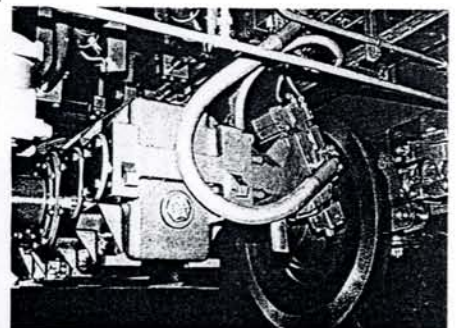
As the locomotive is equipped with a complete electronic control system, the customer's special operation requirements can be easily met by adapting the software regarding:

- time and speed parameters
- specific safety requirements
- tractive efforts and braking levels, and so on, allowing for instance to work with the locomotive at a constant speed regardless of hauling loads.

## PERFORMANCES LOCOMOTIVE 525 HP



The pumps group:  
2 main traction pumps, 3 auxiliary pumps.



The CMI axle gear box coupled to the hydraulic motor.

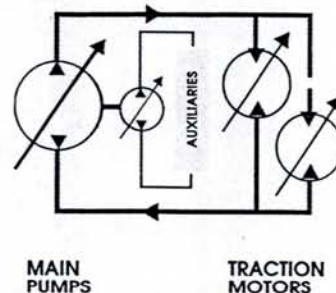
## THE TRANSMISSION INTEGRATED ELECTRONIC CONTROL AND DIAGNOSIS SYSTEM.

DRIVING ORDERS

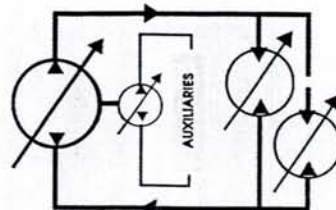
COMPLETE COMPUTERIZED CONTROL OF

- The traction performances (speed and tractive effort)
- The auxiliary equipments operation
- All the locomotive safety functions
- The diagnosis system

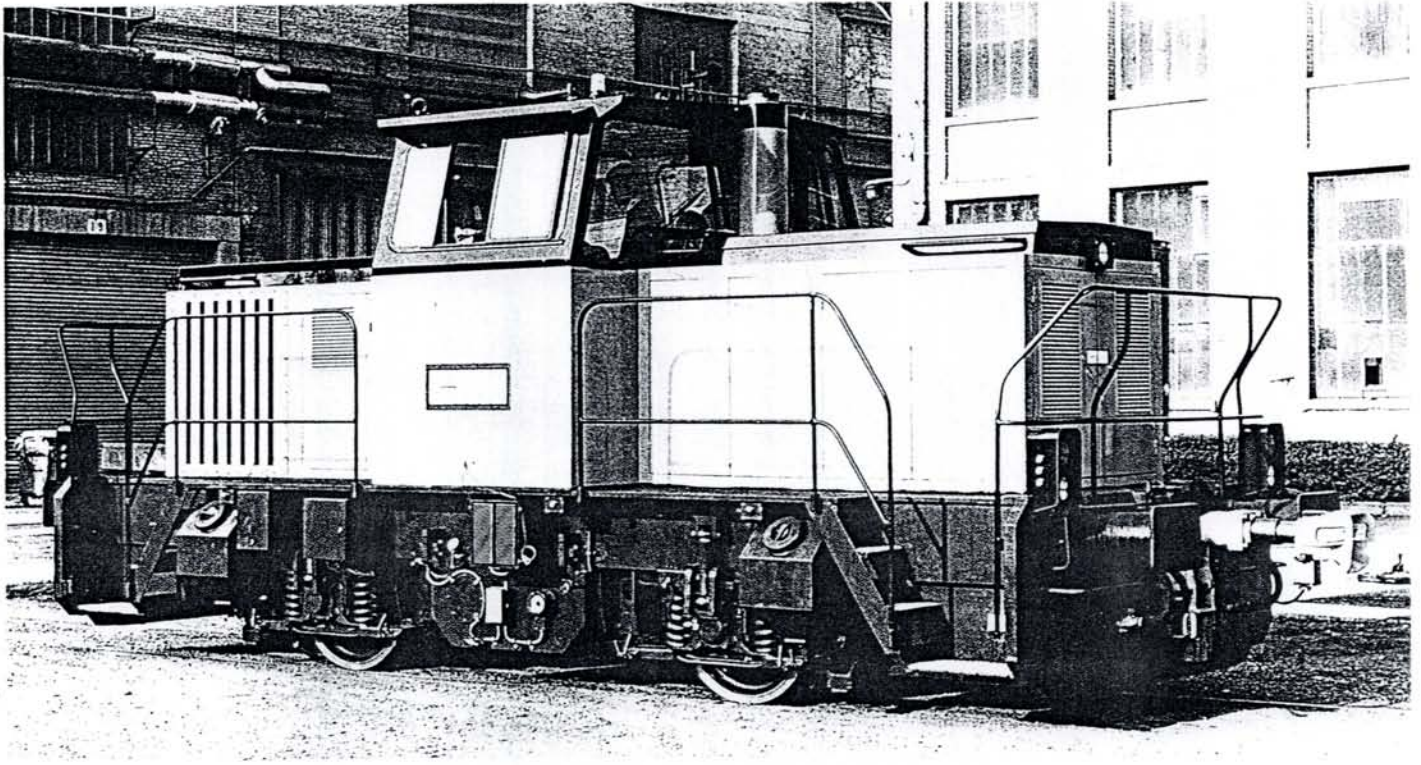
DIESEL ENGINE



AXLE 1



AXLE 2



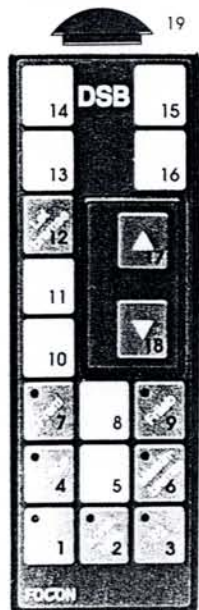
Two ergonomic and comfortably driving desks in diagonal position, offering all around visibility.

The CMI hydrostatic shunting locomotive 525 HP

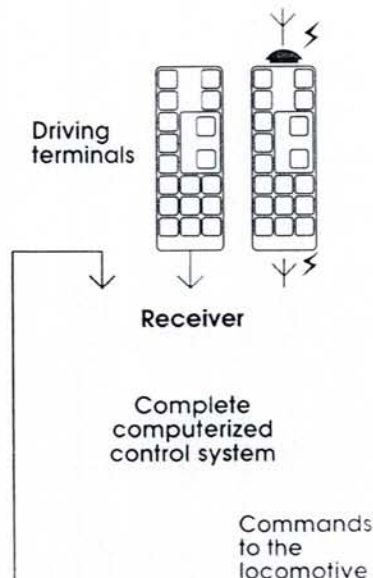


## MAIN CHARACTERISTICS

Weight	40 t
Wheel arrangement	B-2 axes
Diesel engine • Maker	CATERPILLAR
• Type	3408 BTA
• Power	525 HP
• Speed	2100 rev/min
Transmission	Hydrostatic
• Pumps & Motors - Maker	SAUER & SUNDSTRAND
• Axle gear boxes - Maker	CMI Transmissions
Speed	0 to 65 km/h
Traction effort	130 kN starting effort
Remote control	



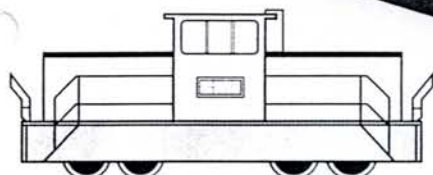
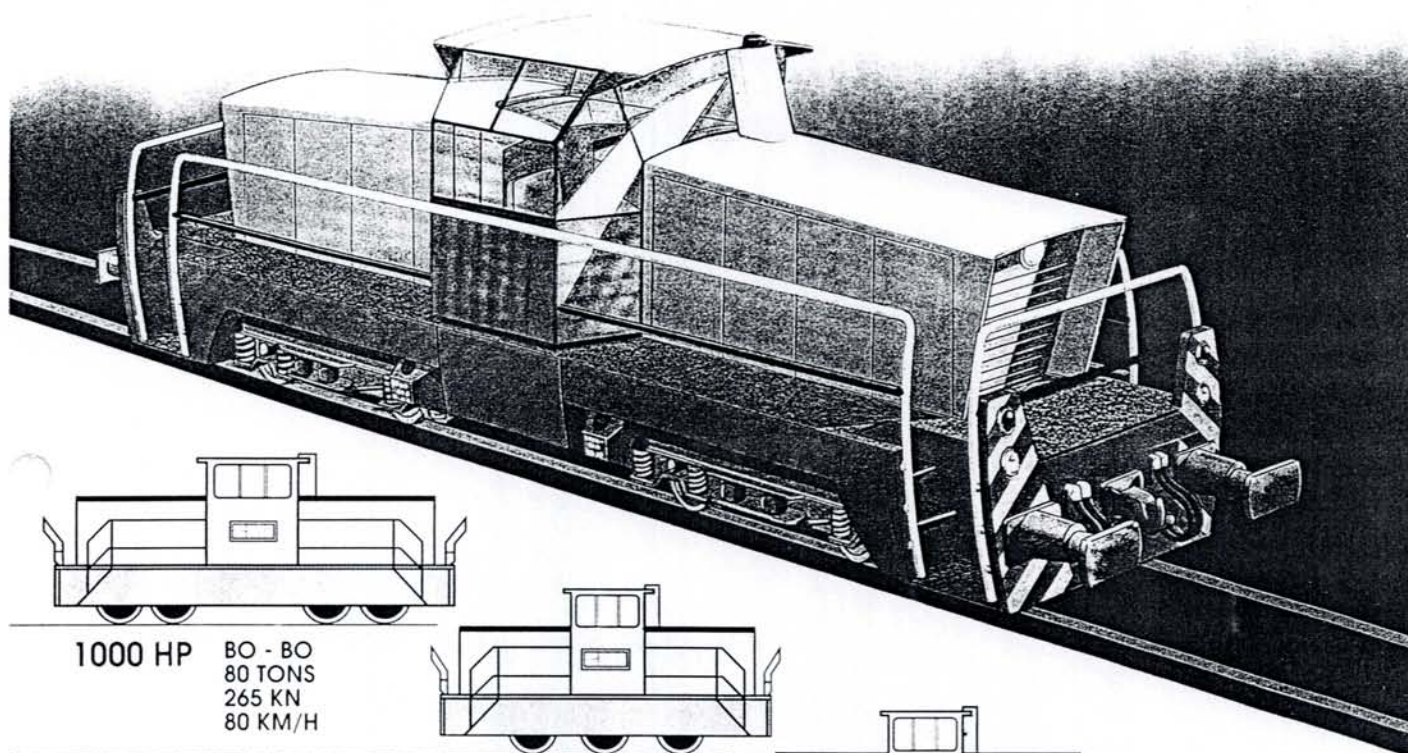
1. F1
2. Constant speed
3. F2
4. Reverse
5. Coupling reverse
6. Direct brake
7. Forward
8. Coupling forward
9. Free wheel
10. Overloading
11. Fast feeding
12. Light brake
13. Mercury switch
14. Horn
15. Light/beeper
16. Coupling
17. Traction plus and brake minus
18. Traction minus and brake plus
19. Emergency brake



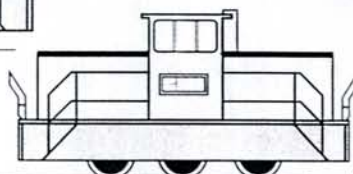
The electronic control and diagnosis system ensures the highest ease of operation.

The driver may introduce the orders optionally from one of the two driving desks or from the remote control terminal, each of them having the same configuration. The execution and management of all the driving orders are entirely processed and monitored by the total safe computer system.

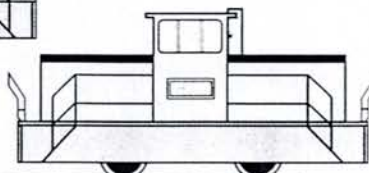
CMI is developing a range of hydrostatic shunting and branch line locomotives.



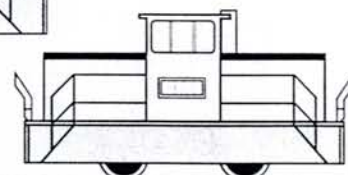
**1000 HP** BO - BO  
80 TONS  
265 KN  
80 KM/H



**750 HP** 60 TONS  
3 AXLES  
200 KN  
65 KM/H



**500 HP** 2 AXLES  
40 TONS  
130 KN  
65 KM/H

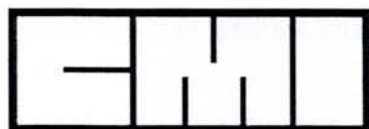


**300 HP** 2 AXLES  
30 TONS  
100 KN  
30 KM/H

### GENERAL CMI - LOCOMOTIVES MANUFACTURING PROGRAMME

shunting and branch line locomotives for all gauges

- Diesel/hydraulic from 250 to 1000 HP with an **hydrodynamic** or an **hydrostatic** transmission
- Electric bimode for non-pollutant applications

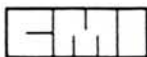


#### Corporate office:

**CMI S.A.** - Avenue Greiner, 1  
B-4100 Seraing - Belgium  
Tel. + 32 41/30.21.11  
Telex 41 225 CKLSAM B  
Fax + 32 41/30.21 13

#### CMI LOCOMOTIVES AND DIESEL ENGINES

Tel. + 32 41/30.23.99  
Fax + 32 41/30.23.89



Objet: Oil spécification.  
réf : (C:\SP\CMI\JPR\91\SPECFLUI.002).

Domaine d'application: Hydrostatic locomotives D.S.B.

Documents de référence: Contract H01/72810.

Ind.	Date	Rédaction	Fabrication	Departement	A.Q.	Description - Référence
E						
D	07/07/93	Das Jlu	HANSOUL	MARCINIAK		CORRECTIONS CONCERNING HYDROSTATIC OIL, FIRST CHARGE ----
C	04/06/93	Das Jlu	HANSOUL	MARCINIAK		UP-DATING AFTER MEETING WITH DSB AND WITH ENMACO DS/
B	28/04/92	Popivis Karin	HANSOUL	R. Capelle		
A	19/01/91	Popivis Karin	HANSOUL	CAPELLE		
			Approbations C.M.I.			



## 1. Oil purpose.

The different fluids destined to the C.M.I. hydrostatic shunting locomotive are used in so far as :

- oil for diesel engine.
- antifreeze and inhibitor solutions for diesel engine.
- oil for hydrostatic transmission.
- oil for transfert gear box between diesel engine and pumps.
- oil for axle gear box.
- oil for air compressor.
- oil for wheel flange lubrication.
- miscellaneous lubrication points : see the Maintenance Plan (specification SH9-452-052).



## 2. Fluid quantities.

The quantities for a complete voidance of the system are given hereafter : ( due to the difficulties for estimating the volume of the tanks and, mainly, the pipes, the values hereafter are subject to some changes in accordance with the definitive filling).

- oil for diesel engine :  
45 liters.
- Total capacity of the diesel engine cooling circuit :  
±150 liters.
- oil for hydrostatic transmission :  
±520 liters.
- oil for transfert gear box :  
±10 liters.
- oil for axle gear box : (for the two gear boxes)  
±80 liters.
- oil for air compressor :  
6.2 liters.
- oil for wheel flange lubrication :  
6 liters.



### 3. Oil voidance schedule.

The hours indicated hereafter are the "service hours" displayed by the "service meter" on the diesel engine, corresponding to approx.50 % of the clock hours.

a. The first charge of oil has to be changed after :

- oil for diesel engine :  
50 hours.
- oil for hydrostatic transmission :  
50 hours for the first change.  
Then 250 hours for the second one.
- oil for transfert gear box :  
50 hours.
- oil for axle gear box :  
250 hours.

b. The following values define the time interval between two oil voidances (also in service hours - see specification SH9-452-052).

- oil for diesel engine :  
every 250 hours.  
This operation should possibly be changed or moved according to the results of the start-up procedure (SH9-452-072)
- antifreeze and inhibitor solutions for diesel engine:  
every 4000 hours.





COCKERILL  
MECHANICAL  
INDUSTRIES

Oil specification for  
shunting locomotive D.S.B.

SH9-452-042-D

Dols J-M

07/07/93.

- Oil for hydrostatic transmission :  
minimum once a year or :  
                                          every 1000 hours.  
This operation should possibly be  
changed or moved according  
to the results of the start-up  
procedure (SH9-452-072)
  
- oil for transfert gear box :  
minimum once a year or :  
                                          every 1000 hours.  
This operation should possibly be  
changed or moved according  
to the results of the start-up  
procedure (SH9-452-072)
  
- oil for axle gear box :  
                                          every 4000 hours.
  
- oil for air compressor : minimum  
once a year or :  
                                          every 1000 hours.



## 4. Oil specification.

This chapter gives the list of all the oils and fluids for use on the MJ hydrostatic locomotives, with possible restrictions where needed.

### a. Oil for diesel engine.

Motor oils in accordance with API CD MIL-L-2014C or CD/TO-2 or CF-4 specifications must fit the diesel engine.

The viscosity is chosen according to outside temperature :

- summer oils (-15°C to +50°C) :
  - o SHELL RIMULA X 15W40 API CF-4.
  - o BP VANELLUS C3 Extra 15W40 API CD  
or equivalent classified CF-4.
- winter oils (-20°C to +40°C) :  
(only in case of cold start-up at -20°C)
  - o SHELL RIMULA X 10W30 API CF-4.
  - o BP VANELLUS FE 10W30 API CD  
or equivalent classified CF-4.



**b. Antifreeze solution for diesel engine.**

This antifreeze product, which has to be mixed to the cooling water in the proportion 50%-50% is pure ethylen glycol.

Another possibility is to use a combined antifreeze / inhibitor solution :

- "summer" charge ( down to  $-11^{\circ}\text{C}$  ) :
  - o SHELL ANTIFREEZE 511 : 20% for 80% of water.
  - o SHELL KEMI A/S : 20% for 80% of water.
  
- winter charge ( down to  $-27^{\circ}\text{C}$  ) :
  - o SHELL ANTIFREEZE 511 : 40% for 60% of water.
  - o SHELL KEMI A/S : 40% for 60% of water.

**N.B. n°1** : generally, a 50%/50% solution enables to reach  $-39^{\circ}\text{C}$ .

**N.B. n°2** : rust inhibitor must be added to the cooling system if the pH of the coolant reaches 8,5 or below. A 3% concentration of corrosion inhibitor must be maintained in the cooling system. Simultaneous concentrations of 65% of antifreeze and 6% of rust inhibitor are not allowed in order to avoid deposits .

**c. Inhibitor solution for diesel engine.**

This product is NALCOOL 2000 (see annexed specification).



Another possibility is to use a combined antifreeze / inhibitor solution ( see above ) :

**d. Oil for hydrostatic transmission.**

An oil in accordance with DIN 51524, part 3 (HV) has to be used.

- summer and winter oil ( $-12^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ) :

- o SHELL TELLUS ÖL T 46.

*N.B. : a cold starting at  $-25^{\circ}\text{C}$ . is impossible. At this temperature, it will be necessary waiting a few minutes with the diesel engine at low iddle until the transmission oil temperature reaches  $-12^{\circ}\text{C}$ .*

- summer and partly winter oil ( $-5^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ) :

- o BP BARTRAN HV 46.

*N.B. : a cold starting at  $-25^{\circ}\text{C}$ . is impossible. At this temperature, it will be necessary waiting with the diesel engine at low iddle until the transmission oil temperature reaches  $-5^{\circ}\text{C}$ .*

- summer and winter oil ( $-12^{\circ}\text{C}$  to  $+90^{\circ}\text{C}$ ) :

The following oils are "environment designed" i.e. "biodegradable". They are synthetic oils and are not miscible with mineral oil without



a complete flushing of the oil circuits.

- o BP BIOHYD 46.
- o PANOLIN HLP SYNTH 46.

e. Oil for transfert gear box.

The recommended viscosity is not dependant of the outside temperature. A E.P.-oil in accordance with DIN 51517 part 3 must be used.

- summer and winter oil (-25°C to +30°C) :

- o SHELL OMALA 220.
- o BP ENERGEAR FE 80W140

f. Oil for axle gear box.

An EP-oil in accordance with :

- DIN 51517.
- a Timken value greater than 60 lbs.
- a load during the 4 ball test greater than 300 kg.
- a FZG fail stage (A/8,3/90) greater than 12th.

has to be chosen. According to the outside temperature, the following oils meet the viscosity requirements.



- summer oil (-7°C to +35°C) :

o SHELL OMALA 320.

- "spring/autumn" oil (-10°C to +27°C) :

A spring and autumn oil is intended to be an oil suitable for light winters and summers, in accordance with the outside temperature range given hereabove.

o SHELL OMALA 220.

- winter oil (-24°C to +10°C) :

o SHELL OMALA 100.

- winter and summer oil (-25°C to +30°C) :

o SHELL TRANSMISSION OIL SAE 80W140.

o OPTIMOL OPTIGEAR HT 220.

o BP MULTIGEAR FE 80W140.

o BP ENERGEAR FE 80W140.

*N.B. : taking into account that BP oils are not standard oils for C.M.I., we cannot warrant the same life expectancy for these oil than for Shell oils .*



**g. Oil for air compressor.**

- summer and winter oil (-25°C to +50°C) :

- o ANDEROL 3057.

**h. Oil for wheel flange lubrication.**

- summer and winter oil (-25°C to +50°C) :

- o SHELL TALPA 40.

- o ASEOL FLANGE 14-52.

- o ASEOL FLANGE R14-54.

**i. Spray grease for hydraulic motors coupling/decoupling system (see Maintenance Plan SH9-452-052).**

Spray aerosol LOCTITE OKS 491.

**j. Grease for BSI automatic couplings or other common greasing points (see Maintenance Plan SH9-452-052).**

K22K grease (DIN 51 502)

ex: SHELL ALVANIA EP grease 2.



## 5. First oil charges.

This chapter gives the list of all the oils and fluids supplied with the MJ hydrostatic locomotives delivered to DSB.

**a. Oil for diesel engine.**

SHELL RIMULA X 15W40.

**b. Antifreeze / inhibitor solution for diesel engine.**

× SHELL ANTIFREEZE 511.

**c. Oil for hydrostatic transmission.**

SHELL TELLUS ÖL T 46.

**d. Oil for transfert gear box.**

SHELL OMALA 220.

**e. Oil for axle gear box.**

SHELL OMALA 220.

**f. Oil for air compressor.**

√ ANDEROL 3057.