INSTALLATION RECOMMENDATIONS

&

PRODUCT INFORMATION

for

World Series MULTIPRESSURE PUMPS

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Introduction

The *World Series WT* range of multi-pressure pumps has been designed from scratch using the knowledge and experience of producing the preceding GM multi-pressure range, which has been in production for many years. However, there is very little mechanical similarity with only a small number of the older pump parts being used in the new design.

Before starting the design an extensive survey was conducted into the features that customers wanted to see in a new pump range. As with all surveys of this kind the 'wish lists' were very diverse, and sometimes contradictory, but wherever possible features have been included which reflect customers' requirements. To this extent our customers have helped to design the new range of twin pressure pumps, which will eventually completely supersede the older GM range.

The new pump range has been designed with future CEN regulations in mind and as such a new pump designation system has been devised. This is explained on page 5.

AMENDMENT RECORD

Model: World Series

Mod No.	Date	Page/s	Amendment	New Issue No.
1	**June 2008**	**26**	**Delete reference to piston primers located in gearbox**	**Issue 1 June 2008**
2	**November 2009**	**17**	**Maximum angle of installation information**	**Issue 2 November 2009**
3	**November 2009**	**All**	**Hale Products Europe changed to Godiva Ltd.**	**Issue 2 November 2009**

Features of the new WT Range

- Reverse rotation version of multi-pressure pumps available for the first time.
- Shorter and more compact pump assembly.
- By-pass and unloading valve eliminated.
- Thermal relief valve fitted as standard.
- New, high-lift automatic piston primers are fitted as standard.
- Automatic friction drive Water Ring Primer available as an option for standard clockwise rotation only (not with gearbox option).
- Automatic V-belt driven Water Ring Primer available with Electro-magnetic clutch as an option on counter clockwise units only (not with gearbox option).
- Improved high-pressure performance at a lower speed.
- Greatly improved high-pressure efficiency.
- HP hose reel isolating valves fitted to pump if required.
- One-piece high-pressure impeller in aluminium bronze material.
- Pressure relief valve to limit high pressure to 55bar maximum.
- Higher pressure ratio between low and high pressures.
- Various HP outlet options, with or without anti-surge valves.
- Lower noise levels than preceding GM equivalent units.
- Simpler construction with fewer components than GM units.
- Removal of sealing gland without removing volute or discharge pipe-work.
- Electronic speed sensor as standard.
- Simpler shaft and bearing assembly.
- Large size angular contact bearings to control axial shaft movement.
- Improved high-pressure inter-stage filter accessible from the front.

- Improved changeover (high pressure selector) ball valve, accessible from the front.
- Pneumatic operation of changeover ball valve as an option.
- Automatic draining of the high-pressure stage.
- More discharge options available.
- Majority of sealing by ‘O’ rings instead of gaskets.
- New AFFF induction system with easily replaceable foam % jets.
- New instrument panel mounted twin flow AFFF metering system.
- New improved sealing gland assembly of carbon and silicon carbide.
- Increased dry running capability.
- Low-pressure water is automatically available at the hose reels with the unit in LP mode.

Special Versions Available:

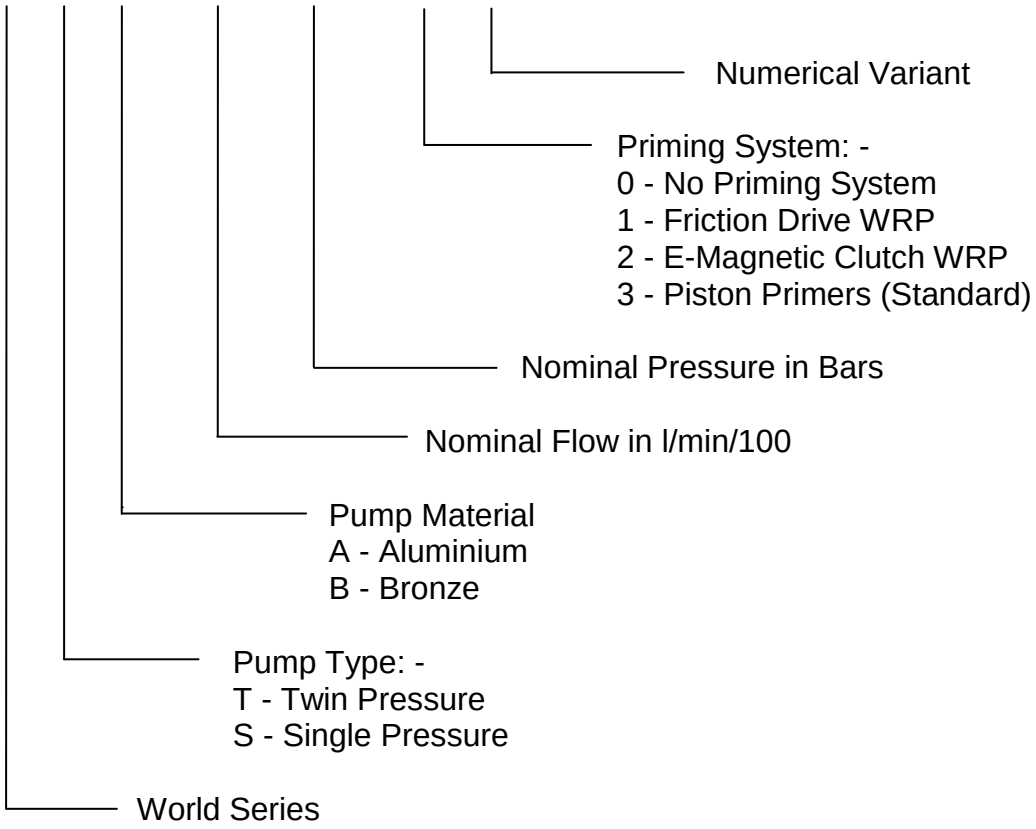
- Fitted gearbox with various ratios and drive input positions is available.
- Fitted with Compressed Air Foam System.
- Fitted instrument panel option available with HP isolating valves.
- SAE2 close-coupled engine mounted version complete with gearbox & electro-magnetic clutch (optional), for airfield crash tenders.

Specification Numbering System

Standard Pump Range

Example:

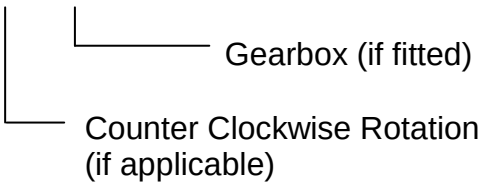
WTA2010/3xx



Special Versions

Example:

WTA2010CG/3xx



Example:

WTAC2010/3xx

C - Compressed Air Foam System (CAFS)
E – Close Coupled Engine Mounted

Note:

- When CAFS 50 is fitted onto a World Series pump, a gearbox will be fitted as standard and the pump specification number will NOT contain ‘G’ (for Gearbox) since the gearbox is no longer an option.
- When CAFS 50 is fitted onto a World Series pump, the only direction of rotation available is clockwise and the pump specification number will never contain the ‘C’ (for Counter-Clockwise Rotation).
- When a World Series pump is close coupled to an engine, a gearbox will be fitted as standard and the pump specification number will NOT contain ‘G’ (for Gearbox) since it is no longer a variable.
- When a World Series pump is close coupled to an engine through the integral gearbox the maximum gearbox ratio that can be specified is **1.8:1**
- When a World Series pump is close coupled to an engine, CAFS 50 currently **cannot** also be fitted.

Conventions

Rotation - When viewed from the drive flange end of the pump and refers to the direction of rotation of the drive flange **only**.

NB! When a gearbox is fitted the pump rotates in the **opposite** direction to the drive flange.

Front - Suction end of the pump.

Rear - Drive flange end of the pump.

LH or RH - When viewed from the front or suction end of the pump.

When a gearbox is fitted the orientation of the drive input position, left, right or down, relates to when viewed from the **suction** end (front) of the pump.

Options Manual

An Options Manual is available from Godiva Ltd., which provides details of all commonly available options for the *World Series WT* pump, including dimensional details, which allow each option to be located in space for installation purposes.

The Options Manual will be periodically updated as necessary when new options become available and is supplied free of charge to OEMs in CD format.

Please contact the Marketing Department of Godiva Ltd. to obtain a copy of GP/148/99. The combined manual includes Installation, Operating Instructions, Workshop Manual and Spare Parts List.

Pump Performance Curves

Performance curves for all the *World Series WT* pumps are available upon request from the Marketing Department of Godiva Ltd..

The models of multi-pressure pump currently available and for which curves are available are: -

WT2010, WT3010, WT4010, WT6010

A separate report 'Understanding Pump Performance Curves', which explains how to interpret the pump performance curves, is also available upon request.

WORLD SERIES WT

INSTALLATION RECOMMENDATIONS & INFORMATION

1. Thermal Relief Valve

Every *World Series WT* pump is fitted with a Thermal Relief Valve (TRV), which is located on top of the central manifold above the volute discharge point. It is very important that the discharge from this valve is piped away from the pump correctly.

The TRV is designed to protect the pump and pump operators in circumstances when the pump is running and the pump discharge outlets have been closed down. In this situation energy absorbed by the pump is converted into heat causing the pump contents to rapidly heat up. When the pump water reaches a temperature of 42°C the standard TRV will start to open and will begin to discharge water at about 48°C. The discharge of hot water from the pump will allow cold water to enter, via the suction tube, thereby stabilising the overall temperature of the pump water.

There is an alternative version of TRV available rated at 74°C, which will start to discharge water at about 80°C. This version should only be used when there is a good operational reason since the water being discharged, and the pump, will be at a temperature capable of causing injury. However since the temperature difference between water entering the pump and that being discharged is higher, the volume of water discharged will be correspondingly less.

The higher temperature TRV may be necessary when the pump is to be used in very high ambient temperature countries. Here the static pump itself may be at a temperature higher than 48°C, which may result in the TRV being permanently open, causing priming problems.

Water discharged from the TRV should ideally be piped back to the top of the vehicle tank and the line fitted with a drain valve to prevent the line freezing in winter. However, this can only be done if no foam passes through the pump.

When a foam system is fitted, discharge must not be to the vehicle tank and could be piped directly to ground. An alternative that could be considered is to pipe the discharge to a holding tank for later disposal at base.

The TRV terminates with an elbow to accept a 12mm (1/2in) bore flexible hose. The discharge from the flexible hose should be led to a safe position away from any operator. The TRV **must not** be fitted with a plug and **must not** be operated without a discharge line. Discharge from the TRV **must not** be returned to the pump suction since the purpose of the TRV is to remove heat from the whole pump.

The TRV will discharge approximately 80l/min @10bar when fitted with a 12mm bore discharge line (minimum recommended). In some circumstances a lower discharge rate will be adequate to keep the unit cool and a restrictor, fitted by the installer, may then be used in the discharge line to reduce the flow. The bore and length of the discharge line will determine the flow rate and the installer must determine an installation that will produce an adequate flow rate to prevent the unit from overheating in his application.

2. Priming

The *World Series WT* pump can provide a variety of priming options namely: -

A. The pump can be supplied with no priming system if required. The piston primer mounting holes are then blanked off. However, it would still be possible to retrofit a priming system at a later date if required.

B. Piston Primers

Piston primers are fitted as standard on the *World Series WT* pumps and discharge from the primers must be piped safely away. There are several ways that the primer discharge can be treated: -

1. The simplest method is to connect a 1" (25mm) bore flexible hose to each primer outlet and allow the discharge to go to ground, under the vehicle and safely away from any personnel.

2. If a foam system is NOT connected to the pump the primer discharge may be returned to the top of the vehicle tank. However, the discharge lines of 1" (25mm) minimum bore should then be fitted with drain valves at the lowest point to prevent freezing in winter.

3. The primer discharge may be piped to a holding tank for later disposal at base or re-circulated back to the pump suction through an appropriate valve system.

Under no circumstances must any discharge line fittings have a clear through bore of less than 21mm diameter.

The discharge lines must not be allowed to kink, should be as short as practicable and should remain independent of each other up to the discharge points. Any dip in the discharge lines in which water can accumulate must be fitted with a drain that can prevent water freezing and plugging the pipe, which could result in catastrophic pump failure.

Each primer will discharge approximately 1 litre every time the pump is required to prime.

During priming the piston primers will emit a characteristic 'popping' noise, which may be unfamiliar to some operators. However, this is entirely normal. Should the noise emitted by the primers, whilst priming, prove to be a problem there is a primer silencer kit available.

Unlike a water ring primer system the piston primers will prime satisfactorily at engine idling speed – it just takes slightly longer. The piston primers should not be run at pump speeds in excess of 2500RPM.

Please note that the piston primer system is fully automatic in operation, requires no maintenance and that a manually operated version is not available.

4. **IMPORTANT**
   When piston primers are fitted the minimum idle speed of the pump should be at least 1200RPM. This speed will allow the pump, when primed with valves closed, to generate sufficient pressure to disengage the primers. Idle speeds lower than this will cause the primers to work continuously resulting in excessive load and wear on the piston primer components. Failures due to insufficient idle speed may not be covered by warranty.

5. When pumping with valves open, the operating pressure, should not be allowed to fall below 2 bar which is the minimum pressure required to keep the primers disengaged. Pumping at a pressure below 2 bar will result in excessive load and wear on the primers.

6. A correctly installed pump should have sufficient free space around each piston primer to allow the primer assemblies to be removed in situ without dismantling the tank to suction line or any other equipment. Recommended clearances for primer removal are shown in the *World Series WT* Option Manual, which is available upon request from Godiva Ltd. in Warwick. Failure to allow insufficient operating space to remove the primers may significantly increase service/repair time.

7. Pumps supplied after Nov 2002 (from serial number 2000) will be fitted with one-piece pistons in the primers. If the primers need to be removed for any reason it is strongly recommended that the pistons be upgraded to the new design at the same time.

8. THE MAXIMUM SPEED OF THE PUMP MUST NOT EXCEED 3600RPM

C. Water Ring Primer

A water ring primer, which is fully automatic in operation, can be supplied as an option. This is mounted over the bearing housing and is driven by a friction pulley. A header tank is normally supplied by the installer, and installation recommendations can be provided if required. In cold climates it is important that the header tank is periodically checked and that the correct anti-freeze concentration is maintained since the header tank water will become slightly diluted every time the pump primes.

A fully manually operated version of the friction drive water ring primer is not currently available.

Currently this option is only available with clockwise rotating pumps.

D. Water Ring Primer with Electro-Magnetic Clutch

A water ring primer fitted with an electromagnetic clutch can be supplied which may be particularly useful to those customers who require the equivalent of a manually operated primer.

This priming system can be operated either automatically through a pump pressure switch mounted on the pump or manually by means of a switch on the instrument panel.

Currently this option is only available with anti-clockwise rotating pumps.

3. Pump Draining

The pump volute is fitted with a screwed plug and it is highly recommended that this is removed and the volute fitted with a drain valve system terminating with a ball valve at a convenient location on the vehicle.

The high-pressure side of the pump will automatically drain down into the low-pressure side (patent applied for), so that only one pump drain point is required.

In order to completely drain the piston priming system the pump should be idled for a few seconds after use with no water in the volute and the drain valve open. This ‘dry prime’ will then evacuate all residual water from the priming system.

It is not recommended that the pump be retained full of water since this could result in freezing in cold climates.

4. Suction Connections

Various suction connections can be supplied including 4" & 5½" Round Thread, BSP, Butterfly Valve, Storz, DIN flange, DIN flange & Ball Valve etc. When a pump is supplied without a suction tube, then the installer must provide priming, foam or sideline connections etc.

Suction tubes manufactured by the installer must have the priming connection at the highest point of the suction tube, as near to the impeller as practicable. The priming pipe should rise gradually from the suction tube to primer connection to aid drainage, or be provisioned with a drain to prevent damage through freezing. The shape and size of the suction tube can have a considerable effect on pumping performance, and Godiva Ltd. technical department would be pleased to advise on any proposed designs.

It is **critically** important that the connection to the primer is such that air is taken from the very **top** of the suction tube. Failure to do this will result in the primer pumping water for extended periods whilst the pump has not generated sufficient pressure to disengage the primers. This will cause excessive load and wear of the primers. Failures due to incorrect positioning of the primer connection will **not** be covered by warranty.

5. Suction Sideline Connection

When a tank to suction line is fitted, normally Ø100mm, it is very important that this line contains a flexible connection such as a Victaulic coupling. If the pump is hard connected to the tank any inevitable flexing of the vehicle chassis will put unnecessary strain on the pump and tank, possibly resulting in failure of pump or tank. Damage caused to the pump due to faulty installation is not covered by the normal pump warranty.

When designing a tank to pump connection line, adequate space must be allowed for removal of the piston primer components during service. The *World Series WT* Options Manual will specify the minimum removal space envelope that must be allowed for by the vehicle builder, particularly for the piston primers, and this space should remain clear of all fixed components.

6. Low Pressure Discharge Connections

The *World Series WT* pump is fitted with a manifold normally having six outlet flanges, two forwards facing, two rear facing and two side facing. When four valves are required the side facing outlets are fitted with suitable outrigger elbows. It is not possible to purchase a *World Series WT* multi-pressure pump without the flanged outlet manifold.

A variety of discharge connections are available, which are generally shown in the *World Series WT* Options Manual. Other variations may be available upon request. Two rear facing flanges are supplied as standard (except when a Water Ring Primer is specified) and may be used for monitor connections or for connecting remote valves etc.

Two, three or four valves may be fitted as standard and these valves may be UK style, continental style, ball valve, or dual flow type. When three valves are fitted the customer should specify whether the third valve is to be fitted on RHS or LHS of the unit. It is not an option, with the *World Series WT* range of pumps, to have a central third valve. The pump can also be supplied without valves if required.

An option not available on previous pumps is two side-facing continental valves, that are mounted horizontally one above the other, on each side of the pump. This arrangement has been designed to suit vehicles with discharge connections at the side of the vehicle.

Most valves can be supplied with quick opening crank handles instead of hand wheels.

Ball valves can be supplied with handles located on either side dependent on the installation requirements. Details can be found in the *World Series WT* Options Manual.

7. High Pressure Connections

Every *World Series WT* twin-pressure pump is supplied with 2 possible high-pressure outlet positions, an upward facing and a rear-facing flange. Both outlets are normally supplied blanked off, if outlet options are not fitted, with the installer then able to choose which one to use. However, if CAFS is fitted only the vertical option is available.

Both discharge outlets can be fitted with an anti-surge valve: -

1. The upward facing outlet can be fitted with an Anti-Surge Valve (ASV) that terminates in an upward facing 1¼" BSP female thread. However, if it is required to use the space above the pump for storage then using this upward facing discharge may be unsuitable due to the increased height of the pump and pipe work assembly.

2. The upward facing outlet can also be fitted with two side facing 1"BSP outlets complete with isolating ball valves and anti-surge valve, if required. This option is especially useful if manual isolating ball valves are required to be operated from a pump mounted instrument panel. The installer can then connect hose reels directly to the pump assembly as supplied.

3. The rear facing outlet can be fitted with either a rear facing ASV which terminates with a rear facing 1¼" BSP female thread or two side facing ASVs which terminate in 1" BSP female threads. Use of the rear-facing outlet does not result in any increase in pump height.

Every multi-pressure pump is fitted with an internal high-pressure relief valve, which ensures that the maximum pressure cannot exceed 55bar (as specified by future CEN standards). Therefore, all high-pressure fittings, valves and hoses that connect the pump HP discharge to the hose reels must have a working pressure rating of 55bar minimum. In fact the components should ideally have an even higher rating than this to allow for pressure pulses in the HP lines.

The high-pressure crossover ball valve is in its CLOSED position when high pressure is generated. Opening this valve will allow low-pressure water to be automatically available at the hose reels in addition to the main low-pressure discharge valves, a standard feature that was not available on the preceding GM range of pumps. However, it is not possible to have low-pressure water in one hose reel simultaneously with high-pressure water in the other, as supplied.

Each high-pressure hose line should be fitted with an isolating valve. Due to the pump being able to provide low-pressure water to the hose reels it is no longer necessary to provide a 3-way ball valve to perform this function. The only exception to this would be if high pressure were required in one hose reel simultaneously with low pressure in the other.

An option is available that allows the crossover ball valve to be pneumatically operated which could be particularly useful for mid-mount installations.

8. Anti-Surge Valves

An option is available whereby each HP discharge connection can be fitted with an anti-surge valve. The purpose of these valves is to prevent pressure surges generated in the high-pressure hoses from being transmitted back into the pump.

If the high-pressure nozzles may be used in a manner that causes pulsing of the water (i.e. in a potential flashover situation) it is **very highly** recommended that anti-surge valves be fitted.

If the high-pressure nozzles may be used in a manner that causes pulsing of the water **and** non-return valves are fitted into a suction collecting head it is **absolutely essential** that anti-surge valves be fitted.

Pulsing of the high-pressure nozzles can cause standing pressure shock waves to travel back down the high-pressure hoses and into the pump. Unhindered these waves will continue to travel backwards through the pump until dissipated down the suction line. However, if a collecting head is fitted containing non-return valves the pressure waves will have nowhere to go and could cause rupture of the weakest component, often the collecting head.

Pulsing of the high-pressure discharge can cause pressure spikes, which will be considerably higher than the nominal pressure. It is therefore essential that the high-pressure hose fittings be able to withstand these high-pressure spikes without blowing off.

It is theoretically possible that the timing of the pulsing could hit a natural frequency of reflected shock waves, which may result in a very significant magnification of the pressure pulse.

The anti-surge valves prevent the high-pressure shock waves from travelling back into the pump. However, the anti-surge valves are deliberately designed to slowly leak (in reverse flow mode) thereby allowing a gradual dissipation of pressure into the pump.

Although the fitting of anti-surge valves will provide some protection for pump components they will not prevent high-pressure hoses fittings from blowing off if their pressure capacity is exceeded. For peace of mind and personnel safety it is therefore essential that adequately rated high-pressure hoses and hose fittings be specified, particularly if pulsing of the water is anticipated.

9. Suction Pressure Relief Valve

If a collecting head fitted with non-return valves is to be used with any *World Series WT* pump then the suction tube must be fitted with a pressure relief valve, which dumps safely away to atmosphere.
A problem could arise when the pump is run in high-pressure mode with the hose reels pressurised but not discharging **and** then the changeover valve switched to low pressure mode, again with no pump discharge. Under these circumstances the high-pressure hoses will have expanded, acting as a pressure accumulator, and when the changeover ball valve is opened this high pressure will be transmitted back into the pump, past the anti-surge valves and could cause excessive pressure in the suction tube.

The pressure relief valve will allow a very small amount of water to escape from the suction thereby limiting the pressure in the suction tube.

If non-return valves are not fitted in the suction collecting head then this relief valve is not required, but if in doubt the valve should be fitted.

When a pump is ordered without a suction tube a suction pressure relief valve will be supplied as a loose item. This must then be fitted by the vehicle

builder to the suction tube immediately before entry into the pump. If a collecting head is fitted the SPRV must be fitted between the collecting head and entry to the pump. The valve fits into
a ¾" BSP threaded hole.

This valve is now fitted as standard to all WT pumps. The SPRV must not be tampered with or adjusted. This will invalidate the pump warranty.

10. Pressure Gauge Connections

Gauge connections and tubing to the suction tube and the LP connection on the central manifold must have a minimum working pressure rating of 19 bar.

The HP gauge connections and tubing must have a minimum working pressure rating of 55 bar.

11. Filters

The *World Series WT* twin-pressure pump is fitted with two filters and access, from the front of the unit, must be provided at all times for cleaning.

The larger filter is spirally wound and filters the water entering the high-pressure system. This style of filter is designed to be far more resistant to blocking than the previous perforated styles.

In low-pressure mode water passes around the high-pressure impeller and is recycled back into the low-pressure system. This recycled water is directed at the spiral filter and thereby helps to scour it clean. However, the filter is only partially self-cleaning and must still be removed at regular intervals for thorough cleaning.

The smaller filter provides filtered water to the inside of the piston primers to lift them out of engagement when the pump is primed. This filter should also be removed at regular intervals for cleaning.

12. Mounting

The pump must be securely fastened onto an adequate cross-member using four M16 high-tensile bolts. Since the pump is naturally front heavy it must be adequately supported whilst the bolts are being fastened or unfastened. All mounting fasteners should be fitted with locking devices.

The pump can be mounted at a maximum angle of ±15° forward/aft angle (That is when viewed from the side of the pump).

13. Noise & Vibration

Since all pumps generate noise it is highly desirable, if possible, to provide some flexibility between pump and chassis. This will help prevent noise and vibration passing to the vehicle structure, which, in some installations, can then act as a loudspeaker.

On full high pressure rated performance the latest version of the *World Series WT* twin-pressure pump will generate a noise level of 83 dB when completely isolated from any supporting structure. However, poor vehicle installation could cause this figure to be considerably exceeded.

Practical tests have demonstrated that, with a correctly installed pump, the engine noise will completely overwhelm any noise that the pump will generate.

Anything that can be done by the vehicle builder to suppress the noise level, such as flexible mounting, enclosing the pump, using sound deadening panelling etc will improve the overall acceptability to the end user.

N.B. If anti-vibration mounts are inserted between the pump and its supporting structure, the mounts **MUST NOT** rely on an adhesive bond for their integrity, but should have a through-bolt fastening. If an A-V mount fails, the through-bolt fastening will ensure that the pump cannot become detached from its supporting structure. The mounting arrangement should be sufficiently strong to resist the maximum torque applied to the pump through the drive shaft.

14. Instrument Panel

The multi-way manifold on top of the pump has been designed so that an instrument panel can be sandwiched between the manifold and valves. Both manifold and valves have provision for 'O' ring type sealing against a panel.

The *World Series WT* twin-pressure pump can be supplied complete with instrument panel with all gauges connected to the pump. The usual pump gauges, high pressure, low pressure and suction compound pressure are provided complete with combined tachometer/hours gauge, together with a selection of engine warning lights and blanked switch holes for customer use.

With agreement, bespoke versions of this panel may also be available. The Godiva Ltd. sales team is able to advise on this.

15. Anti-Clockwise Rotation

The *World Series WT* pump has been designed from the beginning to provide an anti-clockwise version. The overall design is such that both directions of rotation make use of the maximum number of common components in order to keep inventory low.

The positions of the discharge valves, suction tube and high-pressure selector valve are identical for both directions of rotation.

Kits of parts are available which will allow the customer to reverse the direction of rotation from the standard clockwise rotation to anti-clockwise rotation.

NB! Direction of rotation is **always** defined as the direction of rotation of the pump drive flange when viewed from the driveline end.

16. Pump Speed Sensor

Each *World Series WT* pump is fitted with an electronic speed sensor. This sensor is mounted close to the pump drive flange and senses interruptions to a magnetic field caused by two holes drilled into the drive flange. Hence any tachometer fitted must be able to interpret a signal frequency of 2 x Pump Speed. A suitable tachometer with integrated hours run counter is available from Godiva Ltd. (Part No. 60305).

When a gearbox is fitted the electronic speed sensor is located directly in the bearing housing so that pump speed is measured rather than drive flange speed.

There is no mechanical tachometer drive connection provided with any *World Series WT* pumps.

17. Bearing Housing Oil Level

The bearing housing is provided with a combined oil filler/breather/level indicator and a rear facing drain plug.

When a gearbox is fitted the oil drain is directly underneath the bearing housing and a suitable extension, dependent on vehicle installation may need to be provided to allow suitable access for the customer.

Oil levels should only be checked when the vehicle is stationary and level. After use the unit should be allowed to stand for a few minutes to allow oil to drain back into the sump before checking the level.

Oil grade 10W/40 or 15W/40 is recommended for the bearing housing. The oil should be changed every 12 months.

18. Drive Flange

The *World Series WT* pump can be supplied fitted with any of the standard drive flanges available on previous pumps i.e. SAE1410, 1510 Etc & Din100, 120/8 Etc.

Special versions of these drive flanges are available where there is need to drive a Water Ring Primer either by friction drive or by belt through an electro-magnetic clutch.

19. Gland Seal Assembly

A completely new design of gland seal assembly has been produced for the *World Series* range of pumps.

The rotating portion of the seal is made from silicon carbide in a viton cup supported in the high-pressure impeller.

The stationary portion of the seal is carbon supported in a 'floating' stainless steel housing, with the whole stationary assembly being retained as a cartridge. The energising spring is on the dry side of the seal and so is not subject to being contaminated by water borne deposits.

The combination of carbon and silicon carbide has been chosen to give a combination of reliability, long life, abrasion resistance and excellent dry-running capability.

20. Round-the-Pump Foam System Option

The *World Series WT* pumps can be supplied with a 'Round-the-Pump' (RTP) system, which is capable of inducing up to 120 l/min of foam compound into the pump suction tube.

The RTP system is suitable for all commercially available Protein, Fluorocarbon and Aqueous Film-Forming Foam (AFFF) compounds.

An infinitely variable control knob controls the induction rate with calibrated incremental markings from 0 to 120 l/min. This is a purely manual system, which allows the operator full control of the water/foam mix ratio.

The RTP system is bolted to the pump suction tube and driving water is piped from the low-pressure manifold system through a venturi, thereby creating a vacuum, which draws the foam compound from its tank. The foam can be supplied directly from the vehicle onboard foam tank or from a free standing tank.

21. AFFF Foam Induction System Option

In addition to the RTP system described above a new AFFF foam induction system has been developed which will accurately induce the very low quantities of AFFF compound necessary for operation using the high-pressure hose reels only. The AFFF compound is automatically switched on and off with operation of the nozzles. Operation of each hose reel is totally independent of the other i.e. with two hose reels in operation twice the amount of foam can be inducted.

AFFF systems are supplied fitted with 2 x 3% metering jets as standard but 1% and 6% jets are also available. Jets can be easily changed in situ with the aid of a spanner. With the new design it is no longer necessary to dismantle the AFFF unit at the workshop to change the jets.

Precise quantities of AFFF compound are inducted into the suction tube using the vacuum created by the RTP system to give economic use of AFFF foam from the high-pressure nozzles. Hence it is not possible to have the pump fitted with an AFFF system without a complimentary RTP system.

22. Metered AFFF Foam System Option

A new metering system has been designed for the *World Series WT* pump which is compact, designed for panel mounting and will allow a total of 6 combinations of water/foam flow; 80 & 125 l/min to each hose reel with 1%, 3% or 6% foam concentrate. The metering unit is designed to be located between the foam ON/OFF valve (customer supplied) and the AFFF induction system. When the metering system is used jets are not fitted to the AFFF induction system.

Operation of the metering unit is by means of a rotary knob with 3 indent positions for 80 l/min (1%, 3% & 6%) when turned clockwise, 3 indent positions for 125 l/min (1%, 3% & 6%) when turned anticlockwise and a central OFF position.

23. Proportional Foam System Option

Every *World Series* pump can now be fitted with a proportional foam induction system for low-pressure water. This system will allow a fixed percentage of

foam to be inducted at a rate dependent on the volume of water being discharged, up to 4000l/min.

There are two separate foam input feeds to the system each supplying 3% and both can be used together to provide a 6% solution. An optional third feed can also be supplied to provide a 1% class A foam solution.

The three foam feed lines to the system will be provided by the vehicle builder complete with control valves and a flushing connection for each foam feed. It is envisaged that the control valves and flushing system will be electrically operated from the control panel. Non-return valves are fitted to the foam inlets, which prevent the possibility of water being back feed into the foam tanks when there is a pressurised suction. The 3% feeds are each 1" BSP and the 1% line is ¾" BSP. The lines from foam tank to proportioner should not be restricted since this will have an adverse effect on the metering.

The three (or two) foam outlet lines from the proportioning system are connected to a new RTP induction system on the pump suction tube via hard piping.

The foam proportioning system can be supplied on both clockwise and anti-clockwise rotating pumps.

23. Compressed Air Foam System (CAFS) Option

Every standard clockwise rotating *World Series WT* pump can now be fitted with the new integrated compressed air foam system (CAFS). This option is **not** available with **any** counter clockwise rotating pump version and is only available with a piston priming system; i.e. a water ring priming system option is **not** available.

When CAFS is fitted, the pump will automatically be supplied with a gearbox. This reverses the direction of rotation of the pump to give a suitable direction of rotation of the compressor. The various options regarding gearbox ratios and available orientations are discussed in section 25.

Water is diverted from the low-pressure manifold and fed, via a non-return valve, into a venturi assembly where a measured amount of foam is injected dependent on water flow though the venturi. This foam compound is then fed to an air control valve at which dry or wet foam can be selected. Compressed air, provided by a pump-mounted compressor, is then injected and the resulting foam/water/air combination is thoroughly mixed before being fed to a discharge flange.

Various safety interlocks are provided:

1. Air cannot be injected if there is no foam being injected. This prevents 'slugging' in the discharge line caused by the air and water, which cannot mix.

2. Air cannot be injected if there is no water flowing. This avoids the possibility of having the discharge line filled with only compressed air.

3. Even if, for some reason, there is no foam or compressed air available it is still possible to use water alone in the foam discharge line.

4. A low level switch in the foam tank will stop air injection when the tank is empty to prevent 'slugging'.

5. If the compressor lubricating oil reaches 100°C, a warning light will illuminate on the control panel, and if it should reach 105°C the electromagnetic clutch will disengage the compressor drive.

The air compressor is belt driven and switched on and off by means of an electromagnetic clutch mounted on the end of the pump shaft and is fitted with an automotive style air cleaner. The compressor is a screw type with the oil cooled by means of a 'shell & tube' type oil cooler from water diverted from the main pump.

A pneumatically operated ball valve, operated by a manual switch, controls the foam quality i.e. wet or dry. A measured amount of water is allowed to by-pass the ball valve for the dry foam condition with the ball valve being fully open for the wet condition.

A warning light is provided for 'hot compressor oil' and a foam tank level gauge can be fitted to the instrument panel (if fitted). The appropriate foam level sender is supplied with the gauge. The foam tank must be fitted with a low level switch to provide a signal for the interlock control. The foam tank to pump line must be fitted with an isolating valve (½" full bore) to allow the foam filter to be serviced.

Isolating valves on the foam discharge lines are to be provided by the vehicle builder. Any valves connected to the CAFS discharge line must have a clear through bore i.e. ball valves. Gate valves and/or fog guns etc will destroy the quality of foam produced.

Experience has shown that a 38mm bore hose connected to a 25mm plain bore nozzle will give the best quality of foam.

The integral pump/CAFS 50 unit is capable of delivering wet foam to 3 discharge lines. However, quality dry foam can only be delivered through one line.

When the unit is stationary and CAFS is switched off the system should be left in the 'wet' condition. This will allow the manifold system to drain and help prevent freezing.

24. Vehicle Design Considerations for Integrated CAFS 50 Installations

In order for the integrated World Series pump & CAFS 50 to be successfully installed into a vehicle certain criteria should be followed: -

1. The compartment containing the pump & CAFS 50 assembly must be adequately shielded from the ingress of road spray/debris and surplus grease from universal joints etc. Ingress of dirt, water and grease etc will have a detrimental effect to the working life of the drive belt, electromagnetic clutch, pneumatics and electronics etc.

2. Access to all the various drain and fill points must be catered for. This is an especially important consideration in vehicles where the fuel tank location makes access to drain points difficult. To this end the assembly can be supplied complete with a partial chassis member into which all water & oil drain points are factory pre-connected and designed to be accessible from the pump bay. This partial chassis member is supplied complete with rubber mounts to flexibly isolate the pump from the chassis.

3. To allow access for routine maintenance and repair the side locker walls adjacent to the pump assembly must be fitted with large removable/hinged panels. Equipment and racks in the side lockers must be easily removable for pump maintenance access.

4. When fitted with CAFS 50 the unit is usually supplied complete with an instrument panel. This will be of white plastic coated stainless steel and will contain all the necessary controls and gauges for operating the unit. There is scope for providing additional switches where necessary and this should be discussed with the Hale Sales Team.

5. The CAFS system will terminate at a flanged discharge face with a 50mm bore. The casting itself can be rotated to one of three positions dependent on the direction of discharge required. One or two discharge lines of 38mm can then be fitted as required.

6. It is presumed that the CAFS discharge will be through one or both of the side lockers and that the pipe work and isolating ball valves are the responsibility of the vehicle builder. Sealed blank caps **must not** be fitted. Any pipe work or valves fitted should have a clear through bore of 38mm as far as the nozzle.

7. The best quality of foam, especially dry foam, is achieved with a single parallel pipe nozzle of up to 38mm diameter or two

nozzles of 22mm diameter. However these cannot be used for interior attack since the fireman will always be using a fogging gun inside a building. Ø38 – 45mm lay flat hose is recommended. The optimal solution for interior attack is to use a nozzle that has a smooth through bore and which can then be converted to fog as required. Foam outlets should be colour coded.

8. The foam tank should be of plastic or stainless steel with a volume of main tank volume x 0.005. Alternatively, a volume of at least 25l may be preferred to allow an entire drum of foam agent to be emptied. Ideally the foam tank should be situated above the level of the foam pump inlet so that the pump does not need to be primed again. The foam tank must have a low foam level switch fitted and must be vented. The low foam level switch is essential since it forms part of the safety interlock system.

9. If both class A **and** class B foams are required to be used in the same CAFS system there **must** be a foolproof method of flushing the system before changing over from one foam to the other since the two foams are not compatible. Failure to do this will result in the foams mixing which could result in a costly strip down to clean the system out or replace parts.

10. The foam feed line should have a ½" bore and be fitted with an isolating tap for maintenance purposes. The isolating tap should be located as close to the tank as possible with the flushing point close to it. This will ensure that the maximum length of hose line can be flushed out. The flushing line should also be fitted with an isolating valve.

11. Provision must be made for a ½" bore foam return line from the foam pump to the foam tank.

12. CAFS can **only** be used when working from open water or from a tank feed. It **must not** be used with a pressurized suction (hydrant) since this will interfere with the water/air pressure ratio.

13. It is highly recommended that the system be flushed after CAFS has been used, particularly if the system is used infrequently. This will help to prevent the foam concentrate from solidifying within the close confines of the metering system.

14. The foam feed line is fitted with a small filter located in the lower instrument panel valve plate, next to the left hand discharge valve. This should be regularly checked and cleaned after first closing the foam isolating ball valve.

25. Gearbox Option

All pump versions can now be supplied fitted with a mounted gearbox. There are three input drive positions available, left, down and right. There are also seven available ratios: -

1.24: 1
1.40: 1
1.59: 1
1.80: 1
1.97: 1
2.16: 1
2.37: 1

The gearbox is cooled by filtered water from the main pump and will be delivered with the cooling system connected. However it may be necessary for the vehicle builder to provide adequate drainage to prevent freezing.
The gearbox is provided with an independent oil lubrication system.

The water ring priming option is not available when a gearbox is fitted.

The gearbox should be filled with BP Energol GR-XP 68 (or equivalent) oil. Oil should be changed annually or after every 250hrs.

26. Engine Mounted Close Coupled Version

Close-coupled versions of the *World Series WT & WS* pumps are now available complete with a built in water cooled gearbox, which can be fitted to any suitably powered diesel engine with an SAE 2 flywheel housing.

An electro magnetic clutch can be fitted between the engine and pump so that the engine can be run with the pump disengaged when required.

The gear ratios available are: -

1.24:1
1.40:1
1.59:1
1.80:1

This gearbox assembly is available either without a priming system or with a piston primer system only. The water ring primer option is not available.

27. Pump Drives Lines

When installing pump drivelines it is essential that correct alignment criteria be observed. In addition to choosing adequate drive flanges and prop shafts, the single equivalent driveline angle must be no more than about 7º. It should be remembered that there are two accelerations and decelerations for every revolution. The higher the single equivalent drive line angle then the higher will be the magnitude of the forces generated by the accelerations. High driveline angles have been known to cause premature failure of both pumps and gearbox power takeoffs. The situation is made more acute when high speeds are also involved.

Similarly, drive lines into the pump should not be absolutely straight since the needle bearings in the universal joints will then not be working satisfactorily and may also fail prematurely.

28. Heated Pump Version

Components are available for the *World Series* range of pumps that allow the pump to be heated in cold environments to help prevent freezing of the pump. To achieve this engine water would be permanently piped to the pump and circulated through special pump and primer cavities before being returned to the engine cooling system.

The engine water pump circulation could be controlled by means of a valve so that the water can be isolated at warmer times of the year.

29. Special Tools

In order to make repair and maintenance of the *World Series WT* pump easier and more convenient a range of special tools have been designed and are available for purchase. Details of these can be obtained through the Godiva Ltd. sales team.

30. Servicing

The *World Series WT* range of pumps has been designed from the outset to make servicing and repair of the pump as easy and convenient as possible.

The design allows the pump to be progressively stripped down as far as sealing gland replacement without the need to remove the volute or pressure-side pipe work. Even the discharge valves can be left undisturbed.

The bearing housing oil seals run on individual wear rings so that replacement costs of worn components are kept as low as possible.

Wherever possible seals are of the 'O' ring type so that problems of scraping off old gasket material and fitting new gaskets is avoided.

The low-pressure impeller is designed so that positive sealing is provided between impeller and pump shaft. In this way water borne deposits are prevented from penetrating into the small clearances between shaft and impeller, which over time would otherwise accumulate and solidify making removal of impeller difficult.

Components that may be otherwise difficult to access for removal are provided with threaded holes, which can be used for jacking purposes. Usually the screws holding on the component are the same as required for jacking and can be used as such.