



**MDM PUMPS LTD**  
 Spring Lane  
 Malvern, Worcs.  
 England.  
 WR14 1BP

Tel: +44 (0)1684 892678  
 Fax: +44 (0)1684 892841

E-mail: [info@mdmpumps.co.uk](mailto:info@mdmpumps.co.uk)  
 Website: [www.mdmpumps.co.uk](http://www.mdmpumps.co.uk)

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# Upper Temperature Limits

## Bearing Grease Upper Temperature Limits

Standard bearings are fitted with grease that has an upper temperature limit between +140°C and +180°C, depending on the motor manufacturer. An upper temperature limit of +140°C should be assumed unless stated otherwise.

Where required, motors can be supplied with high-temperature bearings whose grease has an upper temperature limit of +200°C.

## Seal Elastomer Upper Temperature Limits

Seal Material	Maximum Allowable Temperature Of Liquid (Continuous)*	
	Generally*	Water/Steam
EP rubber	135°C	150°C
Pure PTFE (mechanical seal seat ring)	180°C	180°C
Fluorocarbon (Viton®) rubber	200°C	135°C (Any product containing water)
Silicone 70	200°C	200°C
Glass-filled/reinforced PTFE	230°C	230°C

\*The actual temperature limit will depend on the chemical properties of the product that is in contact with the seal material. Note also that where a quotation includes compliance with the 3-A standards, the maximum temperature of the seal materials may need to be lowered. Details are available on request.

## Design Temperature

The design temperature of the pump is taken to be either the temperature limit of the bearing grease, or the temperature limit of the seals when in continuous contact with water or steam, whichever is lower.

For example, where a pump is fitted with silicone joint rings (temperature limit with water/steam = 200°C), a mechanical seal with EP rubber (temperature limit with water/steam = 150°C) and a motor with standard bearings (temperature limit of bearing grease = 140°C), the design temperature is taken to be 140°C.

Note: The term 'design temperature' is taken to mean the maximum allowable temperature of water or steam in the pump when the pump is stationary, *not* the maximum allowable *working* temperature.

## Maximum Allowable Working Temperature

### Guaranteed Value For An Existing Or Quoted Pump

If you need to know the maximum allowable working temperature for an existing pump or for a quotation then you should refer to the MDM pump data sheet. The maximum allowable working temperature is the maximum value shown on the 'Temperature' line in the 'Liquid' section of the MDM pump data sheet. MDM Pumps Ltd guarantees that the pump can be operated with liquid at this temperature, but subject to any restrictions (such as flow, minimum suction pressure, ambient temperature, etc.) shown elsewhere on the data sheet.

If you cannot find the MDM pump data sheet for an existing pump, or were not supplied one with a quotation, please contact MDM Pumps Ltd for advice.

## Guideline Value

The *upper limit* on the maximum allowable working temperature is 95°C<sup>†</sup> for a standard pump. The table below shows some liquids that can be pumped at this temperature, subject to the restrictions listed below. Note that this is a guideline value only and does not constitute a guarantee that a particular pump can operate at this temperature.

Examples Of Sealing Materials			
Mechanical Seal	Joint Rings	Other Features	Liquids That Can Be Pumped Up To 95°C <sup>†</sup>
EP/C/SiC	Silicone or EP	None	Towns water; milk; vinegar; a 'CIP' solution of 2% sodium hydroxide (NaOH)/caustic soda in water
<b>PTFE</b> /C/SiC	Silicone or EP	None	De-ionised/Demineralised water (DIW); water for injection (WFI)
EP/ <b>SiC</b> /SiC	Silicone or EP	Continuous low-pressure water flush	Beer/Brewer's wort; citric acid (maximum 10% concentration)

†This reduces to 70°C where a 9.2kW motor is used.

### Pumping Liquids Over 95°C

We can supply units of a special design for pumping liquids at higher temperatures (e.g. superheated water up to 135°C or vegetable oil up to 180°C). This applies to centrifugal pumps only. Non-standard motor options would also be required. Details are available on request.

### Restrictions On Guideline Value

Any guideline value given for the maximum allowable working temperature is subject to the following restrictions:

- a) The motor must have a temperature rise to Thermal Class B (80K). 9.2kW motors are therefore excluded.
- b) The sealing materials must be compatible with the product up to the temperature stated.
- c) There must be sufficient plant suction pressure to prevent the pump from cavitating and also to prevent the liquid from vaporising between the mechanical seal faces.
- d) The ambient temperature must not exceed 40°C (104°F).
- e) The altitude must not exceed 1000m (3280 feet) above sea level.
- f) The atmosphere must be non-humid.
- g) The cooling of the pump and motor must not be restricted. For example, sufficient clearance must be given behind the motor, and the pump must not be lagged or fitted with a heated water jacket.
- h) The motor must not be overloaded. It is the responsibility of the user to ensure that the flow, liquid density (specific gravity) and liquid viscosity do not exceed the maximum allowable values (shown on the MDM pump data sheet). Where a quotation does not include an MDM pump data sheet and makes no mention of density or viscosity, then values for water are to be assumed.
- i) Any guideline value also assumes that the motor is not inverter controlled, and that the unit is operated at a fixed speed from a 50Hz supply.

### Factors Affecting The Maximum Allowable Working Temperature

- 1) Motor specification: Bearing temperature limit and temperature rise class.
- 2) Seals specification: Materials.
- 3) Chemical properties of the liquid being pumped.
- 4) Physical properties of the liquid being pumped (such as the vapour pressure, which determines the plant NPSHA, and whether or not the liquid crystallises or leaves atmospheric deposits).
- 5) Plant suction pressure (this also determines the plant NPSHA).
- 6) Load on motor (this is affected by the density, viscosity and flow of the liquid being pumped).
- 7) Cooling of unit (this is affected by the ambient temperature, altitude, relative humidity, clearance behind motor, and speed of motor).
- 8) Flow (this affects the NPSHR and the load on the motor).

Factors (3) and (4) are dependent on the product and factors (5) to (8) are dependent upon the operation. The pump supplier only has control over (1) and (2).