PRODUCT CATALOGUE
for the METAL FINISHING INDUSTRY

CONTENTS

Heating and Control Solutions that exceed Industry Expectations

OVER-THE-SIDE (OTS) HEATING ELEMENTS

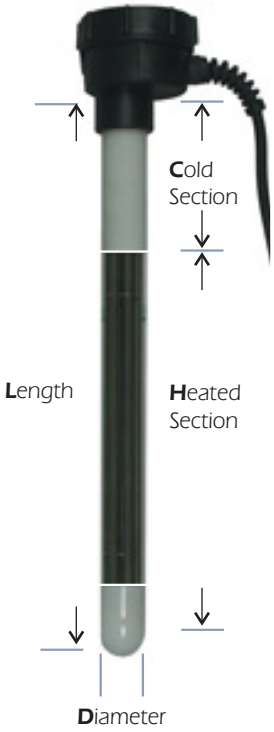
- An important heating requirement is the calculation of the exact kW required including heat losses
- Where possible heaters should be installed in multiples of three to balance the phases
- Regular servicing of heaters is essential to ensure that other heaters in the tank are not overworked (stay on longer) thereby increasing the element's life span
- An LED monitor for each element can be fitted into the polypropylene head which will immediately indicate element failure
- Various sheath materials are available to suit any chemical heating application
- All heaters supplied complete with 2 metre 3 core PVC cable

Typical heater assembly with LED monitoring

Typical heater insert

The convenient **screw off** polypropylene cap provides a vapour tight seal that offers easy access for checking and replacing elements

Cross section showing heater assembly



ORDERING OPTIONS

- Optional LED failure detection unit with three indicating lights
- Non-standard hot and cold zones can be supplied on request
- Other sizes and wattages available on request

STANDARD STAINLESS STEEL, TITANIUM & GLASS HEATING ELEMENTS (rated at 240V)												
	7kW	5kW	*3kW	5kW	4kW	3kW	*1,5kW	3kW	*1,5kW	2kW	1,5kW	1kW
Lmm	1500	1500	1500	1000	1000	1000	1000	750	750	600	500	300
Cmm	350	350	350	250	250	250	250	250	250	200	200	100
Hmm	1120	1120	1120	720	720	720	720	470	470	370	270	170
Dmm	40	40	40	40	40	40	40	40	40	40	40	40
W/cm²	4.2	3.0	1.8	4.6	3.7	2.8	1.4	4.2	2.1	3.7	3.7	5.0
TEFLON COATED	4000W - 7600mm long bent and shaped as per customer specifications											

* In phosphating solutions a number of low kilowatt heaters are recommended rather than one high kilowatt heater.

TYPICAL SHEATH MATERIAL FOR OTS HEATERS

- **Stainless steel heaters** are suitable for use in phosphating, alkaline or neutral pH solutions such as degreasing or rinsing

- **Titanium heaters** can be used in a wide range of alkaline and acidic solutions
- It is important to be aware of varying temperature and concentration of solutions which can cause chemical attack
- In electroplating processes such as nickel plating, the titanium sheath should be connected to act as an anode to prevent corrosion

- **Quartz glass (Vitrosol) heaters** are made from clear fused silica quartz
- Suitable for heating acidic solutions as the tube is inert to most acids
- Not suitable for use in hydrofluoric acid or strong alkaline solutions
- To prevent mechanical damage the sheath should be protected by using a polypropylene or PVC guard
- Using the highest wattage element can result in mechanical damage due to thermal shock
- Lower wattage element inserts are strongly recommended

- **Telflon coated incoloy heaters** are suitable for heating chemical solutions which are aggressive (acidic or alkaline)
- Typical applications include hydrofluoric acid / ammonium difluoride, zinc or ammonium chloride solutions
- These heaters can be bent and shaped to suit customer requirement
- A combination of low watt density and teflon coated heaters in galvanizing flux applications significantly reduces build up on the sheath

Elements supplied to the Metal Finishing Industry generally use high watts density ("red heat") elements which heat up the air in the sheath which then transfers heat to the solution. Even though this form of heating is inefficient it is the best solution where aggressive chemicals need to be heated. The sheath protects the heater from corrosion and/or chemical attack thereby considerably extending the life span of the element. However the inefficiency of the heating process means that cycling the elements is essential to ensure longevity of the heater.

TEMPERATURE AND LEVEL PROBES

- The temperature probe should be placed at a reasonable distance from the heaters in order to keep accurate temperature control
- Temperature probes are available in varying lengths and can be halar coated particularly where aggressive solutions are present
- The liquid level probe lengths should be measured and installed to match the cold end marker on the heater

Stainless steel liquid level probe

Halar coated liquid level probe

STANDARD LENGTHS FOR LEVEL PROBES	
STAINLESS STEEL	HALAR COATED
750mm	750mm
1000mm	1000mm

*** Other lengths available on request**
*** Titanium level probes available on request**

Stainless steel temperature probe

Halar coated temperature probe

STANDARD LENGTHS FOR 3-WIRE PT100	
STAINLESS STEEL	HALAR COATED
300mm	300mm
400mm	400mm
500mm	500mm

*** Other lengths available on request**
*** Titanium temperature probes available on request**

PVC guard

Polypropylene guard

PVC / POLYPROPYLENE GUARDS	
500mm	600mm
750mm	1000mm
1500mm	

*** Other lengths available on request**

TEMPERATURE CONTROL UNITS

- Most temperature control systems still use simple on / off controllers
- A digital temperature controller which uses PID control will ensure that the deadband on setpoint is reduced thereby improving the accuracy of the temperature loop
- All elements need to be cycled thus it is recommended to use temperature controllers

On/off temperature controller

STANDARD FEATURES

- 11 pin plug in on/off temperature controller
- Input: (thermocouple, RTD)
- Output: Relay 240 VAC switching 2A
- Auxiliary 240 VAC (50 Hz)
- Size: 48 x 48mm

STANDARD FEATURES

- Input: (thermocouple, RTD)
- On / off P, PD or PID control
- Programmable
- 2 alarm outputs (selectable)
- Universal supply 90...264 VAC (50 Hz)
- Output: Relay
- Facia sizes: 48 x 48mm, 72 x 72mm, 96 x 48mm, 96 x 96mm

Digital temperature controllers

LIQUID LEVEL CONTROL UNITS

- A liquid level control unit ensures that the level of the heated solution remains at a constant level, thereby eliminating element failure
- A build up of conductive material between the probes resulting in incorrect level readings can be eliminated by adjusting the sensitivity potentiometer

STANDARD FEATURES

- Input: Resistance
- Adjustable potentiometer for sensitivity
- 11 pin plug in unit
- Auxiliary supply 240VAC
- Output: Relay 240VAC switching 2A

- Swift designs, installs and commissions electrical and temperature control panels
- Liquid level and temperature control systems can be fitted into existing control panels or into new designs
- These panels are designed strictly according to customer specifications and requirements

- Our service department offers contracts for our technical staff to regularly check all elements and control systems on processing plants
- Installation of OTS heaters, liquid and temperature probes into tanks, and wiring up to the control panel is offered as an option
- Contact our service department for more information

CALCULATING POWER REQUIREMENTS FOR TANK HEATING

STEP 1 Calculate temperature (always assume minimum is 0°C)

STEP 2 Calculate the litres in the tank — Water $1m^3 = 1$ kilolitre $= 1000$ kg

STEP 3 Ascertain specific heat — For stainless heaters - specific heat = 1

For vitrosol heaters (acid) - specific heat = 0.75

STEP 4 Calculate heat up time

Initial heat up time is 12 hours and should suffice for overcoming heat losses and heat sink from materials dipped into the tanks

STEP 5 Add % onto kW for heat losses and insulation losses

- Polypropylene tanks (25%)
- Well insulated metal with fibrefrax and cladding (25%)
- No insulation - metal (50%)

Placing a sheet of thick bubble wrap or polystyrene balls overnight on top of the solution will greatly reduce heat losses and power consumption

$$\text{Calculation in kW} = \frac{\text{mass x specific heat x temperature rise}}{\text{860 x heat up time (hours)}}$$

E.g. Company A has a 7000 litre degreasing tank with a temperature of 60°C. The tank is well insulated and initial heat up time is not critical. The company needs to determine the power required

$$\frac{7000 \times 1 \times 60}{860 \times 12 \text{ hours}} = 40 \text{ kW} + 25\% \text{ heat loss safety margin} = 50\text{kW}$$

Note: Most plants are under designed resulting in higher heater failure due to the elements not cycling adequately

Major causes of heat loss

- Location of plant - indoors or outdoors
- Lack of tank insulation
- Lack of surface insulation, especially overnight and weekends if tanks are left on
- High volumes of material throughput
- Use of air agitation

TANK HEATING REFERENCE CHART (uninsulated) using stainless heaters				
Heating up time - 12 hours				
Tank sizes in litres	50°C	60°C	70°C	80°C
500	2.5kW	3kW	3.5kW	4kW
1 000	5kW	6kW	7kW	8kW
2 000	10kW	12kW	14kW	16kW
3 000	15kW	18kW	20kW	24kW
5 000	25kW	30kW	34kW	39kW
10 000	50kW	60kW	68kW	78kW

*** a percentage needs to be added to compensate for heat losses**

SHEATH MATERIAL SELECTION CHART

POWDER COATING	CHEMICALS USED (all mixed with water)	ELEMENTS
1. Degreaser (60 - 80°C)	Alkaline Degreaser	Stainless - any wattage
2. Acid Rinse (40 - 50°C)	Phosphoric or Sulphuric Acid (30%)	Vitrosol or Teflon
3. Phosphating (60°C)	Iron Phosphate, Phosphoric Acid, Sodium Molybdate Mix	Stainless - lowest wattage possible
4. Passivating (50 - 60°C)	Sodium Dichromate, Chromic Acid Mix (very diluted)	Stainless - any wattage
ELECTROPLATING	**CHEMICALS USED (all mixed with water)**	**ELEMENTS**
1. Degreaser (60 - 70°C)	Alkaline Degreaser	Stainless - any wattage
2. Acid Pickle (40 - 50°C)	Hydrochloric Acid or Sulphuric Acid or mix of two (30%)	Vitrosol or Teflon
3. Electroplating Process		
a) Nickel (60°C)	Nickel Sulphate, Nickel Chloride, Boric Acid	Vitrosol or Titanium or Teflon
b) Chrome (40 - 45°C)	Chromic Acid	Vitrosol
c) Copper Alkaline (45°C)	Copper Cyanide, Sodium & Potassium Cyanide	Stainless
d) Copper Acid (25°C)	Copper Sulphate & Sulphuric Acid	Vitrosol
e) Zinc Acid (25°C)	Ammonium or Zinc Chloride	Vitrosol or Teflon if heated
f) Brass (40°C)	Zinc, Copper Cyanide & Ammonium Chloride	Stainless, Vitrosol or Titanium
4. a) Nickel stripper (70°C)	Cyanide	Stainless - any wattage
b) Stripper (stripping old plating before re-plating)	Hydrofluoric Acid or Ammonium Diflouride	Teflon only
GALVANISING	**CHEMICALS USED (all mixed with water)**	**ELEMENTS**
1. Degreaser (60 - 70°C)	Alkaline Degreaser	Stainless - any wattage
2. Acid Pickle	Hydrochloric / Sulphuric Acid	Vitrosol if heated
3. Flux (60°C)	Ammonium or Zinc Chloride (50%)	Vitrosol or Teflon
ANNODISING	**CHEMICALS USED (all mixed with water)**	**ELEMENTS**
1. Degreaser (50°C)	Caustic free Degreaser	Stainless - any wattage
2. Dyes (40°C)	Organic Dyes	Vitrosol
3. Seal (70°C)		
a) Boiling Water (100°C)	Water	Stainless
b) Nickel based (70°C)	Nickel based sealer	Vitrosol