The MTC series of portable temperature calibrators facilitates correct readings on all of your temperature monitoring devices. The MTC dry-block design does not use any hazardous hot liquid and heats up and cools down much faster than traditional ways of calibrating temperature sensors on a vessel. You can reach 320°C (608°F) in just 4 minutes and do it safely.

The MTC series of portable temperature calibrators facilitates correct readings on all of your temperature monitoring devices. The MTC dry-block design does not use any hazardous hot liquid and heats up and cools down much faster than traditional ways of calibrating temperature sensors on a vessel. You can reach 320°C (608°F) in just 4 minutes and do it safely.

Maintain and calibrate monitoring devices for:
- Turbo-charger lubrication
- Fuel oil inlet
- Exhaust gas
- Crankcase protection
- Turbine and gear bearings
- Steam
- Servo oil propeller pitch
- Purifiers
- Starting air
- Hydraulic systems
- Oil burner
- Generators
- Safety valves
- Cylinder/piston/fuel valve cooling media
- Thrust/shaft plane/stern tube bearings
- Lubricating oil systems
- Scavenge air
- Sea water cooling
- Charge air
- Uptake gas
- Feed water
- Cooling water outlet
- Refrigeration systems
- Gland steam
- Condensing system
- Main steam
- Condensers

» Wide temperature range
MTC-140 A -17 to 140°C / -1 to 284°F
MTC-320 A 33 to 320°C / 91 to 608°F
MTC-650 A 33 to 650°C / 91 to 1202°F

» Fast calibration is timesaving
The specially designed heating block profile heats up to 320°C / 608°F in just 4 minutes and to 650°C / 1202°F in only 10 minutes

» High flexibility
Not limitations by fixed holes. Interchangeable insertion tubes are used to match the diameter of the sensor-under-test

» Enhanced stability
MVI circuitry ensures stability despite mains supply variations in the engine room environment

» Timesaving features
Fast one-key-one-function access to the automatic switch test and auto-stepping

» Documentation made easy
RS232 communication interface and JOFRACAL calibration software package are part of the standard delivery

» DNV approval
All JF Instruments calibrators are marine type approved by Det Norske Veritas

» Complete marine program
Part of a complete program of marine approved temperature, pressure and signal calibrators; including temperature sensors
The MTC series features a large backlit display that is easy to read even in well-lit areas. Units feature an informative display that provides icons and information regarding the status of the MTC and the calibration in-progress. The MTC series also features an auto-step function. Using this function you may stay in the control room or on the bridge and monitor the temperature reading while the calibrator, located in the engine room by the sensor, automatically steps through a number of pre-programmed temperatures.

Fast heating and cooling
The MTC-320 A and the MTC-650 A contain an innovative heating block profile. This design heats up the MTC-320 A to maximum temperature in just 4 minutes and the MTC-650 A in only 10 minutes. The fast performance of the heating block is due to the special profile that minimizes mass and yet, still accepts an insertion tube with a 1 in (26 mm) outer diameter. This design is a balanced compromise between temperature stability, homogeneity, and rapid heating and cooling.

MTC-140 A heating/cooling block
The model MTC-140 A features Peltier elements. In 1834, Jean Peltier, a French physicist found that an "opposite thermocouple effect" could be observed when an electric current was connected to a thermocouple. Heat would be absorbed at one of the junctions and discharged at the other junction. This effect is called the "PELTIER EFFECT".

The practical Peltier element (electronic heating pump) consists of many elements of semiconductor material that are connected electrically in series and thermally in parallel. These thermoelectric elements and their electrical interconnections are mounted between two ceramic plates. The plates serve to mechanically hold the overall structure together and to electrically insulate the individual elements from one another.

MVI - Improved temperature stability
MVI stands for "Mains power Variance Immunity". Unstable mains power supplies are a major contributor to on-site calibration inaccuracies. Traditional temperature calibrators often become unstable in shipboard environments where large electrical motors, heating elements, and other devices are periodically cycled on and off. The cycling of supply power can cause the temperature regulator to perform inconsistently leading to both inaccurate readings and un-stable temperatures.

The MTC series calibrators MTC-320 A and MTC-650 A employ the MVI, thus avoiding such stability problems. The MVI circuitry continuously monitors the supply voltage and ensures a constant energy flow to the heating elements.

The MTC-140 A does not require the MVI circuitry because the Peltier elements are energized with a stabilized DC voltage.

Easy-to-use, intuitive operation
All instrument controls may be performed from the front panel. The heat source is positioned away from the panel. This design helps to protect the operator.

The main functions on the MTC series are designed with one-key-one-function logic. This means that there are no sub-menus or difficult to remember multiple keystrokes necessary to access primary functions.

The easy-to-read, backlit display features dedicated icons, which help in identifying instrument conditions and operational steps.
Set temperature
The "Up" and "Down" arrow keys allow the user to set the exact temperature desired with a resolution of 0.1°C or °F.

Instrument setups
The MTC series stores the complete instrument setup, including: engineering units, stability criteria, resolution, display contrast, slope (ramp) rate, auto-step settings, and maximum temperature.

Stability indicator
The bold checkmark (✓) on the display indicates that the calibrator has reached the desired set temperature and is stable. The operator may change the stability criteria and establish a greater sense of security in the calibration results. A convenient countdown timer is activated five minutes before the unit reaches stability.

Automatic switch test
Operators can save a lot of time using the automatic thermoswitch test function to find values for the "Open" and "Close" temperatures. Additionally, this feature displays the hysteresis (deadband) between the two points. The feature ensures a very high repeatability when testing thermo-switches. Simply press the SWITCH TEST key to activate the function.

Auto-stepping
This feature saves manpower. The operator may stay in the control room, or on the bridge, monitoring the output from the sensor-under-test while the MTC series calibrator is placed in the engine room and automatically changes the temperature using a programmed step value and rate. Up to 9 different temperature steps may be programmed, including the hold time for each step.

Maximum temperature
From the setup menu, the user can select the maximum temperature limit for the calibrator. This function prevents damage to the sensor-under-test caused by the application of excessive temperatures. The feature also aids in reducing drift resulting from extended periods of exposure to high temperatures. This feature can be locked with an access code.

Re-calibration/adjustments
The MTC series has a very easy and straightforward procedure for re-calibration/adjustment. There is no need for a screwdriver or PC software. The only thing you need is a reliable reference thermometer.

Place the probe in the calibrator and follow the instructions on the display. Third-party labs and calibration facilities will be able to perform this function if a certificate from an independent source is necessary. Of course, AMETEK can provide you with a traceable calibration certificate from our labs when you require a higher level of confidence.

JOFRACAL CALIBRATION SOFTWARE
JOFRACAL calibration software ensures easy calibration of RTD’s, thermocouples, transmitters, thermoswitches, pressure gauges and pressure switches.

JOFRACAL can be used with JOFRA DPC-500, HPC and IPI pressure calibrators, all JOFRA temperature calibrators, as well as JOFRA AMC900, ASC300 multi signal calibrator and ASM-800 signal multi scanner. When used with JOFRA ASM-800, JOFRACAL can perform a simultaneous semi automatic calibration on up to 24 pressure and/or temperature devices under test in any combination.

JOFRACAL software controls the complete calibration procedure, stores the results and provides a calibration audit trail through hard-copy certificates. All calibration data are stored for each sensor to monitor drift and optimise recalibration intervals. A scheduler feature allows planning of future calibrations.
**Mains specifications**
Voltage MTC-140/320/650 A 115V (90-127) / 230V (180-254)
Frequency, non US deliveries ..................... 50 Hz ±5, 60 Hz ±5
Frequency, US deliveries .......................... 60 Hz ±5
Power consumption (max.) MTC-140 A ............ 150 VA
Power consumption (max.) MTC-320 A / 650 A .... 1150 VA

**Temperature range**
MTC-140 A
Maximum ........................................... 140°C / 284°F
Minimum @ ambient temp. 0°C/32°F .......... -30°C / -22°F
Minimum @ ambient temp. 23°C / 73°F .......... -17°C / -1°F
Minimum @ ambient temp. 40°C / 104°F ...... -2°C / 28°F
MTC-320 A ........................................... 33 to 320°C / 91 to 608°F
MTC-650 A ........................................... 33 to 650°C / 91 to 1202°F

**Resolution (user-selectable)**
Selectable .................................................. 1° or 0.1°C/F

**Stability**
MTC-140 A ........................................... ±0.05°C / ±0.09°F
MTC-320 A / 650 A .................................... ±0.1°C / ±0.18°F
Measured after the stability indicator has been on for 10 minutes. Measuring time is 30 minutes.

**Time to stability (approximate)**
MTC-140 A ........................................... 5 min.
MTC-320 A / 650 A .................................... 8 min.

**Accuracy**
MTC-140 A ........................................... ±0.4°C / ±0.7°F
MTC-320 A ........................................... ±0.5°C / ±0.9°F
MTC-650 A ........................................... ±0.9°C / ±1.6°F
Specification when using the internal reference. (Load 4 mm OD reference probe in the center of the insert).

**Immersion depth**
MTC-140 A (insulation included) .............. 115 mm / 4.5 in
MTC-320 A / 650A .................................... 110 mm / 4.3 in

**Heating time**
MTC-140 A -17 to 23°C / 1 to 73°F ............ 3 minutes
MTC-140 A 23 to 140°C / 73 to 284°F .......... 15 minutes
MTC-320 A 33 to 320°C / 91 to 608°F ........... 4 minutes
MTC-650 A 33 to 650°C / 91 to 1202°F ......... 10 minutes

**Cooling time**
MTC-140 A 100 to 0°C / 212 to 32°F .......... 10 minutes
MTC-140 A 0 to -15°C / 32 to 5°F .......... 13 minutes
MTC-140 A 140 to 100°C / 284 to 212°F ...... 15 minutes
MTC-320 A 320 to 100°C / 608 to 212°F .... 16 minutes
MTC-650 A 650 to 100°C / 1202 to 212°F .. 28 minutes

**Switch input (dry contact)**
Test voltage ........................................ Maximum 5 VDC
Test current ........................................ Maximum 2.5 mA

**Engine rooms - testing the temperature in exhaust gas**

**Savings**
The exhaust gas temperature is a very important factor. If the temperature is too low, too little fuel is let into the cylinder, and if the temperature is too high, too much fuel is let into the cylinder.
Often a range of ±10°C (50°F) is allowed, before an alarm is activated. However, if calibration is performed more often, this range could be reduced and a more economical combustion could be achieved.
**KEY FEATURES**

**Automatic switch test**
Finds switching temp. .......................Open, close, hysteresis
Slope rate, programable ......................0.1 to 9.9 °C/°F

**Auto stepping**
Programmable ........................................... Up to 9 steps
Dwell time on each step .......................Programmable

**Enhanced stability**
Unstable mains protection .................. MVI Circuitry
Stability indicator ................................. Yes, in display

**Multi-information display**
Stability indicator ......................... Bold checkmark
Countdown timer before stable .......... 4 minutes
Temperature ...................... SET and READ simultaneously
Alphanumeric messages .................. Yes
Calibration status icons .................. Yes

**Training mode (heating/cooling block disabled)**
Simulation of all functions ................ Yes
Simulating heating and cooling .......... Approx. 100° per minute

**Service facilities**
Adjustment of the unit from the keypad .......... Yes
Self explanatory guide in display .......... Yes

Other information: Displays serial number, software revision level, and last calibration date

**Setup facilities**
Stability criteria .................. Extra time before "stable indication" is shown
Display resolution ....................... 0.1° or 1°C/°F
Temperature units ................... °C and °F
Slope rate ................................ 0.1 to 9.9°/minute
Maximum temperature .................. Any value within range

**Type approval certificate**
All JOFRA Instruments calibrators are type approved by Det Norske Veritas. Find the certificate at our web-page www.jofra.com

DNV Marine Approval, Certificate no.: .......... A-10549

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**PHYSICAL SPECIFICATIONS**

**Instrument dimensions**
L x W x H: .......... 241 x 139 x 325 mm / 9.5 x 5.5 x 12.8 in

**Instrument weight**
- MTC-140 A .................. 6.5 kg / 14.3 lb
- MTC-320 A .................. 5 kg / 11 lb
- MTC-650 A .................. 6.4 kg / 14.1 lb

**Insert dimensions**
- MTC-140 A
  - Diameter x length: 19 mm x 100 mm / 0.75 x 3.9 in
- MTC-320 A, MTC-650 A
  - Diameter x length: 26 mm x 120 mm / 1 x 4.7 in

**Weight of non-drilled insert (approximate)**
- MTC-140 A .................. 2.6 oz / 75 g
- MTC-320 A .................. 5.8 oz / 170 g
- MTC-650 A .................. 17.8 oz / 510 g

Use of other inserts may reduce performance of the calibrator. To get the best results out of the calibrator, the insert dimensions, tolerance and material is critical. We highly advise using JOFRA inserts, as they guarantee trouble free operation.

**Shipping (with std. accessories + carrying case)**
- Weight: MTC-140 A .................. 12.5 kg / 27.6 lb
- Weight: MTC-320 A .................. 11 kg / 24 lb
- Weight: MTC-650 A .................. 12 kg / 27 lb
- Size: L x W x H: ........ 507 x 232 x 415 mm / 19.9 x 9.1 x 16.3 in

**Shipping (with std. accessories but no carrying case)**
- Weight: MTC-140 A .................. 10 kg / 22 lb
- Weight: MTC-320 A .................. 8 kg / 17.5 lb
- Weight: MTC-650 A .................. 9.5 kg / 21 lb
- Size: L x W x H: ........ 465 x 255 x 470 mm / 16.4 x 9.8 x 14.6 in

**Shipping (carrying case only)**
- Weight: .................. 5.0 kg / 11 lb
- Size: L x W x H: ........ 507 x 232 x 415 mm / 19.9 x 9.1 x 16.3 in

**Miscellaneous**
- Serial data interface .................. RS232 (9-pin Male)
- Operating temperature ................. 0 to 40°C / 32 to 104°F
- Storage temperature ................. -20 to 50°C / -4 to 122°F
- Humidity ..................................... 0 to 90% RH
- Protection class ................................. IP-10
- ......................... EN61010-1 : 1993/A2:1995
STANDARD DELIVERY
- MTC dry-block calibrator (user specified)
- Mains power cable (user specified)
- Traceable certificate - temperature performance
- Insert (user specified)
- Tool for insertion tubes
- User manual
- Test cables (1 x red, 1 x black)
- 3 pcs. insulation plugs for:
  - 1/4, 3/8, 1/2 in (6, 10, 13 mm) sensors (MTC-140 A only)
- RS232 cable
- JOFRACAL calibration software

ACCESSORIES
- 122832 Cleaning Brushes - 4 mm - Package of 3 pcs
- 60F174 Cleaning Brushes - 6 mm - Package of 3 pcs
- 22822 Cleaning Brushes - 8 mm - Package of 3 pcs
- 65-F100 Insulation in Tube, 100 mm x Ø25 mm
- 65-F101 Insulation in Tube, 150 mm x Ø25 mm
- 65-F102 Insulation in Tube, 200 mm x Ø25 mm
- 65-F103 Insulation in Tube, 250 mm x Ø25 mm
- 65-F104 Insulation in Tube, 300 mm x Ø25 mm
- 65-F105 Insulation in Tube, 350 mm x Ø25 mm
- 65-F106 Insulation in Tube, 400 mm x Ø25 mm
- 65-F107 Insulation in Tube, 450 mm x Ø25 mm
- 123469 Set with 3 pcs of insulation plugs
  - * 6, 10 and 13 mm / 1/4, 3/8 and 1/2 in. (MTC-140 only)
- 125068 Support rod set for sensors, 2 gribs, 2 fixtures
  - * Support rod set can be mounted on all JOFRA dry-blocks
- 125066 Extra fixture for sensor grib
- 125067 Extra sensor grib
- 125002 Edgeport Converter with 4 pcs of RS232 ports
- 123408 Carrying Case for CTC/MTC A models
- 104216 Thermal Protection Shield

Inserts, heat shield, and cleaning brushes
Always use the original inserts where material and physical dimensions have been optimized. A drilling guide is included if you buy undrilled inserts. Use the cleaning brushes to clean the bores in your inserts when necessary.

Carrying case (Optional) - 123408
The protective carrying case ensures safe transportation and storage of the instrument and all associated equipment. The carrying case is included in the standard delivery.

Marine approved temperature sensors
JF Instruments also has a series of temperature sensors which are type approved by classification societies for marine applications such as measuring exhaust gases, cooling water for diesel engines, and room or temperature in refrigeration stores. These sensors are specially designed with high endurance for vibration according to IEC 68-2-6. Approvals from Lloyd's Register of Shipping and Det Norske Veritas.

Support rod set for sensors (Optional) - 125068
It is possible to order a support rod for sensors, which can be mounted on the side of all JOFRA dry-block calibrators and holds the sensors under test in their position, while calibrating them. The support rod set includes 2 pieces of sensors grips and 2 pieces of fixtures for sensor gribs.

125066 Extra fixture for sensor grib
125067 Extra sensor grib
PREDRILLED INSERTS FOR MTC SERIES

Inserts for MTC-140 A and MTC-320 A are made of aluminium. Inserts for MTC-650 A are made of brass.

All specifications on hole sizes refer to the outer diameter of the sensor-under-test. The correct clearance size is applied in all predrilled inserts.

<table>
<thead>
<tr>
<th>Insert code</th>
<th>MTC-140 A</th>
<th>MTC-320 A</th>
<th>MTC-650 A</th>
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</thead>
<tbody>
<tr>
<td>3 mm</td>
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<td>123436</td>
<td>123444</td>
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<tr>
<td>4 mm</td>
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<td>5 mm</td>
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<td>6 mm</td>
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<td>7 mm</td>
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<td>9 mm</td>
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<td>11 mm</td>
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<td>123433</td>
<td>60F333</td>
<td>105189</td>
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<tr>
<td>14 mm</td>
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<td>18 mm</td>
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UNDRILLED INSERTS FOR MTC SERIES

Inserts, undrilled

<table>
<thead>
<tr>
<th>Insert code</th>
<th>MTC-140 A</th>
<th>MTC-320 A</th>
<th>MTC-650 A</th>
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<td>123937</td>
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### ORDERING INFORMATION

<table>
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<tr>
<th>Order number</th>
<th>Description</th>
<th>Base model number</th>
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<tbody>
<tr>
<td>MTC140A</td>
<td>MTC-140 A, -17 to 140°C (-1 to 284°F)</td>
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<tr>
<td>MTC320A</td>
<td>MTC-320 A, 50 to 320°C (122 to 608°F)</td>
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<tr>
<td>MTC650A</td>
<td>MTC-650 A, 50 to 650°C (122 to 1202°F)</td>
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#### Power supply (US deliveries 60 Hz only)

<table>
<thead>
<tr>
<th>Voltage</th>
<th>Description</th>
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<td>115V</td>
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<td>230V</td>
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#### Mains power cable type

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<tbody>
<tr>
<td>A</td>
<td>European, 230V</td>
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<tr>
<td>B</td>
<td>USA/CANADA, 115V</td>
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<tr>
<td>C</td>
<td>UK, 240V</td>
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<tr>
<td>D</td>
<td>South Africa, 220V</td>
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<tr>
<td>E</td>
<td>Italy, 220V</td>
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<tr>
<td>F</td>
<td>Australia, 240V</td>
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<tr>
<td>G</td>
<td>Denmark, 230V</td>
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<tr>
<td>H</td>
<td>Switzerland, 220V</td>
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<tr>
<td>I</td>
<td>Israel, 230V</td>
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#### Insert type and size

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<td>1x Insert for dry-block configuration (Please see insert section for correct code)</td>
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</table>

#### Calibration certificate

<table>
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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>F</td>
<td>NPL Traceable Calibration Certificate (standard for Europe, Asia, Australia and Africa)</td>
</tr>
<tr>
<td>G</td>
<td>NIST Traceable Temperature Certificate (standard for Americas)</td>
</tr>
<tr>
<td>H</td>
<td>DANAK Accredited Calibration Certificate (Optional)</td>
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#### Options

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<tr>
<th>Code</th>
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<tr>
<td>C</td>
<td>Carrying case</td>
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</table>

Sample order number

<table>
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<th>Sample order number</th>
<th>Description</th>
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<tbody>
<tr>
<td>MTC650A230AM01FC</td>
<td>JOFRA MTC-650 A with standard accessories, 230VAC, European powercord, multi-hole type M01, NPL traceable certificate and carrying case.</td>
</tr>
</tbody>
</table>