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AUTOMATIC TEMPERATURE CONTROL IN OIL AND
GREASE HEATING EQUIPMENT

by

T. Jez

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The authors describe a relay and contractor system for controlling temperature in equipment for warming up oil and grease, incorporating an overshooting means to maintain the previously set temperature. The system is also provided with an additional means for protecting the heaters from an excessive temperature increase. [AP1112308]
<table>
<thead>
<tr>
<th>KEY WORDS</th>
<th>LINK A</th>
<th>LINK B</th>
<th>LINK C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ROLE</td>
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<tr>
<td>Automatic Temperature Control</td>
<td></td>
<td></td>
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<tr>
<td>Lubricating Oil</td>
<td></td>
<td></td>
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<td>Grease</td>
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<td></td>
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<td>Heating</td>
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<td></td>
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AUTOMATIC TEMPERATURE CONTROL IN OIL AND GREASE
HEATING EQUIPMENT

Author: T. Jez

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Abstract: Description is given of a contacting relay system for use in oil and grease heating installations that is capable of automatically maintaining preset temperatures. The system incorporates additional safety features designed to protect the heating installation from excessive temperature increase.

Despite rapid growth of instrumentation, plants within the metalworking industry continue to encounter difficulties when buying installations equipped with control instruments. The difficulties in question apply to a variety of equipment types such as fully fireproof ovens, baths, and degreasing and surface treatment tanks featuring automatic controls.

These equipment types are mostly deficient in safety measures designed to protect against damage to the heater control units and malfunctions resulting from inattention on the part of operators. Incorporation of the control system described below in various heating units will protect them against excessive temperature rise and possible ignition of the contents. The basic concept of the system is shown in the control system (Fig. 1) and power supply (Fig. 2) block diagrams.

The red "on" indicator lamp indicates that power is on. Contactor ST₄ is actuated by pressing button P₂, and is maintained in that position by means of contacts PP and ST₄. Closing the other ST₄ contact causes power to be fed to the coil of contactor ST₁, timer relay PC coil, thermoregulator servomotor and contactor ST₅ coil. Contact ST₅ is itself maintained and feeds power through the other ST₅ contact to the coil of contact ST₂, thus actuating the delta system. The green indicator lamp indicates that the delta system is on.

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Fig. 1. Control system block diagram.

/Key:/ B - safety fuses; I - indicator lights; Dz - alarm bell;
KS - bell switch; P - control switches; PP - auxiliary relay;
PC - time switch; ST4 - auxiliary contactors; TR - temperature
regulator; 1 - indicator lamp L2 (green denotes delta system on);
2 - indicator lamp L2 (white denotes wye system on); 3 - alarm bell;
4 - "on" indicator lamp (red); 5 - operation in delta mode.

Following the preset time lapse (about 5 sec) the timer relay closes
contact PC, thus actuating contactor ST6. Actuation of ST6 causes inter-
ruption of the timer relay FC power supply and prepares the ST6 contactor
system for automatic actuation of the wye mode. Contactor ST7 will not
close since the system is operating in the delta mode and contact ST2 is
open. When the temperature preset by means of the thermostate is
attained, the thermostate contact TH1 will open, and the delta system
will be switched off. Reactivation will occur when the temperature falls
15°C. Then the thermostate contact TH1 will close, and power will be
to contactor ST7 coil. Contactor ST5 coil will not be switched off since ST6 contact remains open. Contactor ST7 will close, supplying power to contactor ST3 coil and thus switching on the wye system.

The opening and closing of thermoregulator contact TR1 causes on and off switching of the wye system in order to maintain the preset temperature. Actuation of the wye system is signalled by the white indicator lamp L2.

![Heater circuit block diagram]

Fig. 2. Heater circuit block diagram. ST1–3 – main contactors.

At the end of the operation, the oil heater installation power supply is cut off by pressing switch P1, and the control system power supply is interrupted by throwing the main switch.

Mention should be made of the safety system used to prevent fire in the event of damage to the heater switch system. When the temperature rises, the temperature regulator TR2 set at a value 15°C higher will attain the preset temperature and will cause contact TR2 to close. The relay PP will switch off contactor ST4, thereby turning off the entire temperature control system. Breakdown deactivation of the system is signalled by ringing of the alarm bell. The ringing can be stopped by pushing switch KS. The heating system is reactivated after the necessary repairs are carried out.

The system described above has been incorporated in oil and grease heating installations at Stalowa Wola steel plant. Systems without the delta-wye switching capability were utilized in installations rated at below 8 kW.

In summary, incorporation of the control system described protects oil and grease heating installations from fire hazard. The fail-safe system switches off the control circuits immediately upon increase in temperature. The system can be reactivated after the necessary repairs are carried out, and the fail-safe mechanism re-set.