

TENU J9 Preheating Relay controls 4 glow plugs and the indicator lamp on the dashboard in KARSAN J9 diesel vehicles.

The current drawn by glow plugs increases logarithmically and reaches extremely high values in low temperatures. The device includes a very powerful internal relay to switch such high currents.



## **Operation**

The device starts energizing glow plugs and indicator lamp with ignition switched on. If engine is started, the indicator lamp goes off and heating continues until engine start key is released. If the engine isn't started, the indicator lamp stays on for a time determined by ambient temperature and heating continues for another 6 seconds after the lamp goes off.

## **Features**

- Temperature-sensing preheating duration
- Shortened preheating in repetitive ignitions
- Powerful relay output
- Full fault protection on relay and lamp outputs
- Overvoltage protection

## **Temperature-dependent preheating duration**

The preheating relay lengthens or shortens preheating duration according to temperature. When the temperature is high enough for engine start without preheating, the indicator lamp and preheating are on only momentarily to avoid unnecessary heating of glow plugs. And at low temperatures, preheating is longer to assure engine start on first attempt. A graph of preheating duration vs. temperature can be seen on page 4. Additionally, if ignition is switched on again within the first 5 minutes after engine stop, preheating duration is reduced down to 2 seconds below normal duration since the engine and glow plugs will still be warm enough for engine start.

## **Relay**

The current drawn by glow plugs at the beginning of preheating can reach very high values up to 150 Amperes at low temperatures. TENU Preheating Relay includes an internal relay able to withstand and supply such high currents.

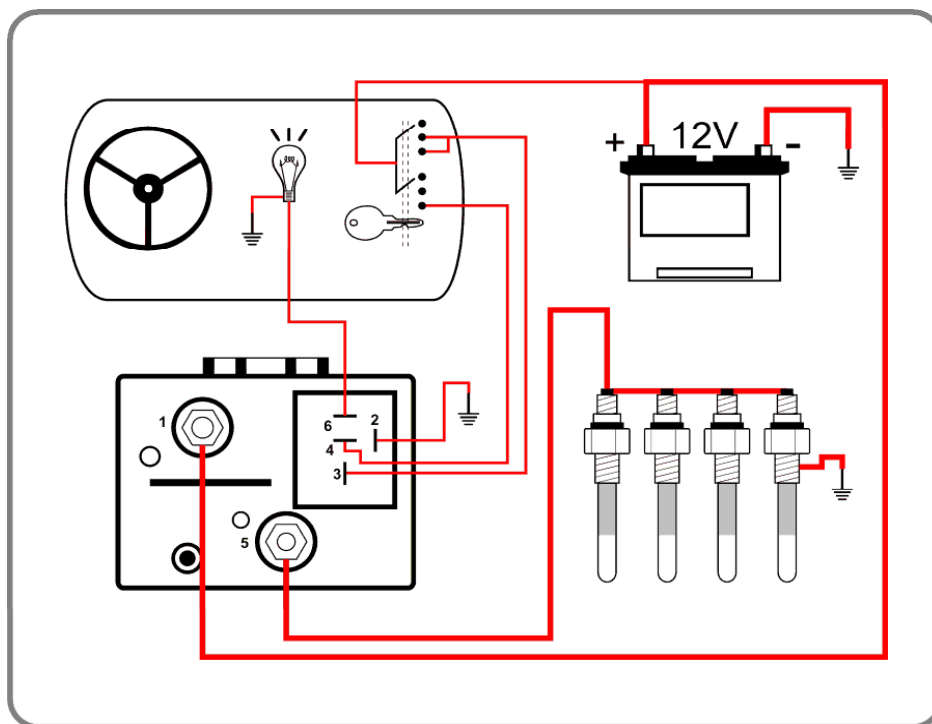
## **Fault Protection**

In case of an overcurrent or short circuit on the relay output at terminal 5 at any moment during operation, the output is cut off immediately. Similarly the indicator lamp output at terminal 6 is also fault protected. The device returns to normal operation when ignition is switched off and on again.

## **Overvoltage Protection**

In order to protect glow plugs, the preheating relay will not operate in case the battery voltage goes over 15V due to a fault in the charge system of the vehicle.

## Connection Diagram



## Electrical Connections

<b>1</b>	Direct +12V from battery	M6 screw terminal
<b>2</b>	Chassis	0,80 x 6,40 mm male blade terminal
<b>3</b>	+12V from ignition switch	0,80 x 6,40 mm male blade terminal
<b>4</b>	+12V from engine start switch	0,80 x 6,40 mm male blade terminal
<b>5</b>	+12V relay output to glow plugs	M5 screw terminal
<b>6</b>	+12V output to indicator lamp	0,80 x 6,40 mm male blade terminal

## Operation Conditions

	<i>Minimum</i>	<i>Average</i>	<i>Maximum</i>	<i>Unit</i>
<b>Voltage</b>	8,5	-	15	V
<b>Glow plug current</b>	-	-	200	A
<b>Indicator lamp current</b>	-	0,15	0,4	A
<b>Overcurrent protection</b>	400	450	500	A
<b>Overvoltage protection</b>	15	15,2	15,5	V
<b>Temperature</b>	-30	-	85	°C

## Timing Values

	<i>Minimum</i>	<i>Average</i>	<i>Maximum</i>	<i>Unit</i>
<b>Indicator lamp "ON" time (at 25°C)</b>	4,5	5	5,5	Seconds
<b>Heating after indicator lamp "OFF"</b>	5,4	6	6,6	Seconds
<b>Indicator lamp "ON" time at 2<sup>nd</sup> engine start attempt (at 25°C)<sup>(1)</sup></b>	0,5	-	5	Seconds
<b>Overcurrent cut off time on relay output (terminal 5)</b>	-	-	0,015	Seconds

<sup>(1)</sup> Indicator lamp "ON" time is reduced if ignition is switched on again within the first 5 minutes after engine stop. The lamp is on for 0,5 seconds if ignition is switched on immediately after engine stop and returns to normal "ON" duration gradually within 5 minutes.

## Relay Endurance

All electromechanical relays have an internal resistance due to body material, contact material and contact size. Therefore a small voltage drop is observed on all relays connected to electrical load.

In relays carrying high currents, electrical arcs occur on the contacts in every make/break operation. These arcs wear out contacts over time, which increases the total internal resistance of the relay, thus increasing the voltage drop on the relay and causing heat which eventually leads to relay breakdown.

To obtain an idea about the contact life of a preheating relay, a wear out experiment can be implemented. The voltage drop between terminals 1 and 5 is measured on a new preheating relay while heating four glow plugs. Then the same device is operated minimum 10.000 times with a full battery and same glow plugs. The voltage between terminals 1 and 5 should not exceed 350 mV after the experiment. (PSA Technical Specification B25 2190)

	<i>New</i>	<i>After experiment<sup>(2)</sup></i>	<i>Unit</i>
<b>Voltage drop between terminals 1 and 5 with 4 glow plugs load at 50A<sup>(1)</sup></b>	90 ±5	102 ±5	mV

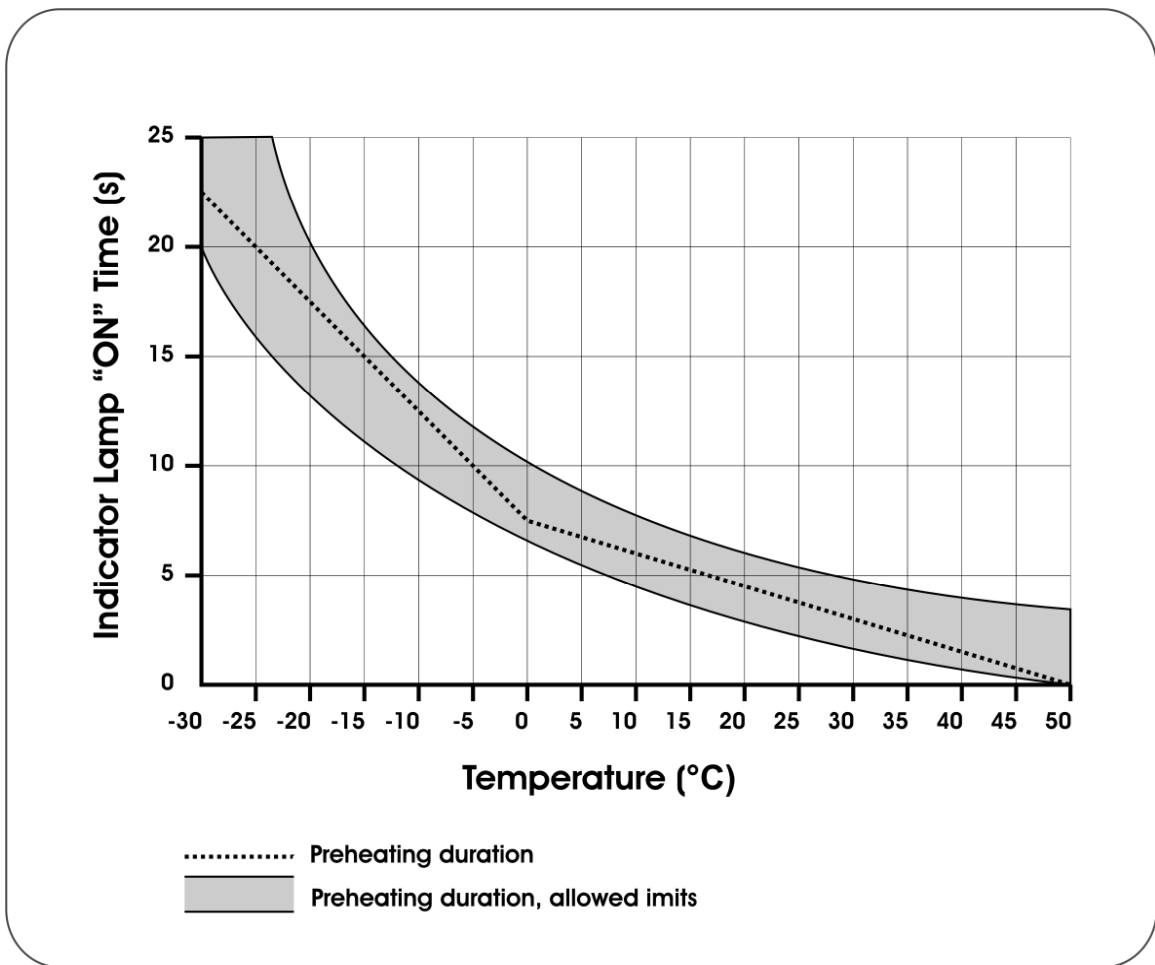
<sup>(1)</sup> At 25°C with 12V battery

<sup>(2)</sup> A TENU Preheating Relay has been operated 12.796 times to energize 4 glow plugs with 200A peak current during wear out experiment in April-May 2005

## Estimated relay life

	<i>Electrical (With glow plugs)</i>	<i>Mechanical (Without glow plugs)</i>	<i>Unit</i>
<b>Minimum</b>	30.000	100.000	Operations

Temperature vs. Preheating Duration (Indicator Lamp "ON" time)



Dimensions (mm)

