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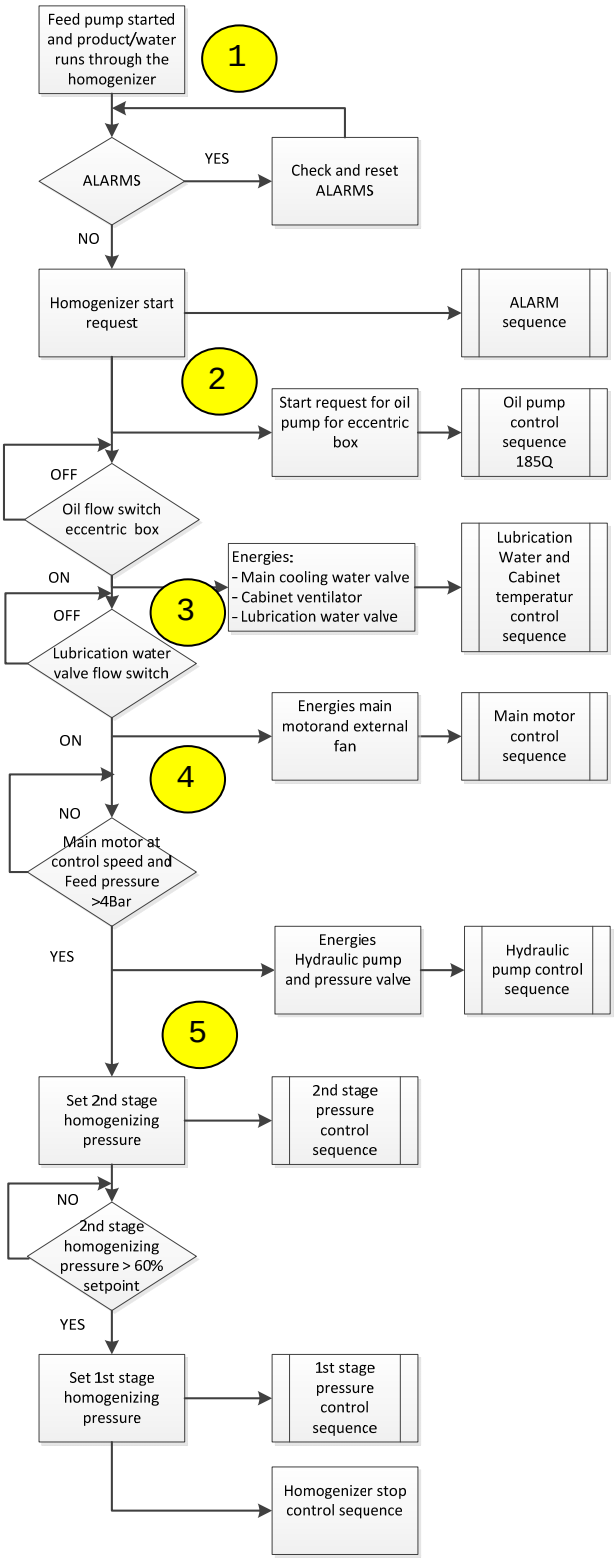
This instruction specifies a general sequential control, based on the machine standard and available options. Please refer to the data sheet for included options and features.

Start control sequence



1 Requirements prior to starting

- 1.1 All alarms from homogenizer package are in their healthy state.
- 1.2 Feed pump started and product/water flows without air through the homogenizer.
- 1.3 See also instruction 7.100 regarding operation conditions.

2 Oil lubrication system control

- 2.1 Energise oil pump motor for eccentric
- 2.2 Wait for signal " Oil pressure on"

3 Power end cooling system control

- 3.1 Energise cabinet ventilators
- 3.2 Energise main cooling water valve
- 3.3 Energise lubrication water valve
- 3.4 Wait for signal " Lubrication water flow"

4 Main motor and hydraulic system control

- 4.1 Energise main motor.
- 4.2 Energise main motor external fan
- 4.3 Energise hydraulic pressure relive valve.
- 4.4 Energise hydraulic pump motor.

5 Loading homogenizing pressure.

- 5.1 Feed pressure must be sufficient depending on the product and homogenizing pressure.
- 5.2 Depending on selected pressure control, adjust or down load the pressure set-point (See note 1) for 2nd stage of the homogenizer (See note 2).
- 5.3 Depending on selected pressure control, adjust or down load the pressure set-point (See note 1).for 1st stage of the homogenizer (See note 2).
- 5.4 When the 1st and 2nd stages are steady the homogenizer is fully loaded.

Note 1: The pressure control can be a signal from a PID/PC or some local arrangement e.g. Mechanical hydraulic valve or potentiometer. The hydraulic system must be set at or adjusted according to the selected control type. See hydraulic setup in the machine manual

Note 2: In some extreme cases is it necessary to down load 1st stage before 2nd stage.

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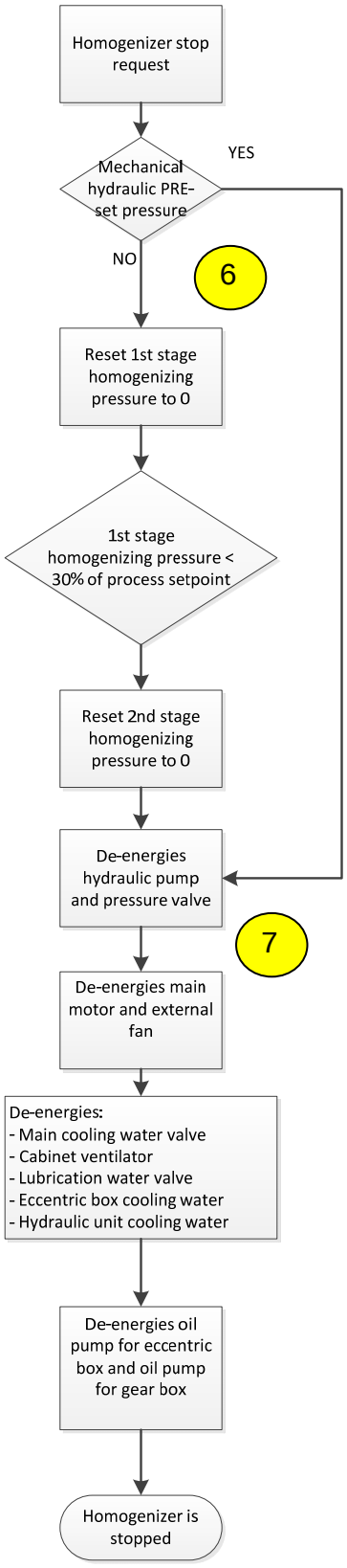
Stop control sequence



6 Unload the homogenizer.

- 6.1 Reset the 1st stage pressure to zero
- 6.2 Reset the 2nd stage pressure to zero
- 6.3 De-energise hydraulic pump motor and unloading valve.
- 6.4 De-energise hydraulic cooling water valve

7 Stopping the homogenizer

- 7.1 De-energise main motor.
- 7.2 De-energise main motor external fan.
- 7.3 De-energise water valves
- 7.4 De-energise cabinet ventilators and oil pump motors
- 7.5 The homogenizer will be left in “stopped” state.

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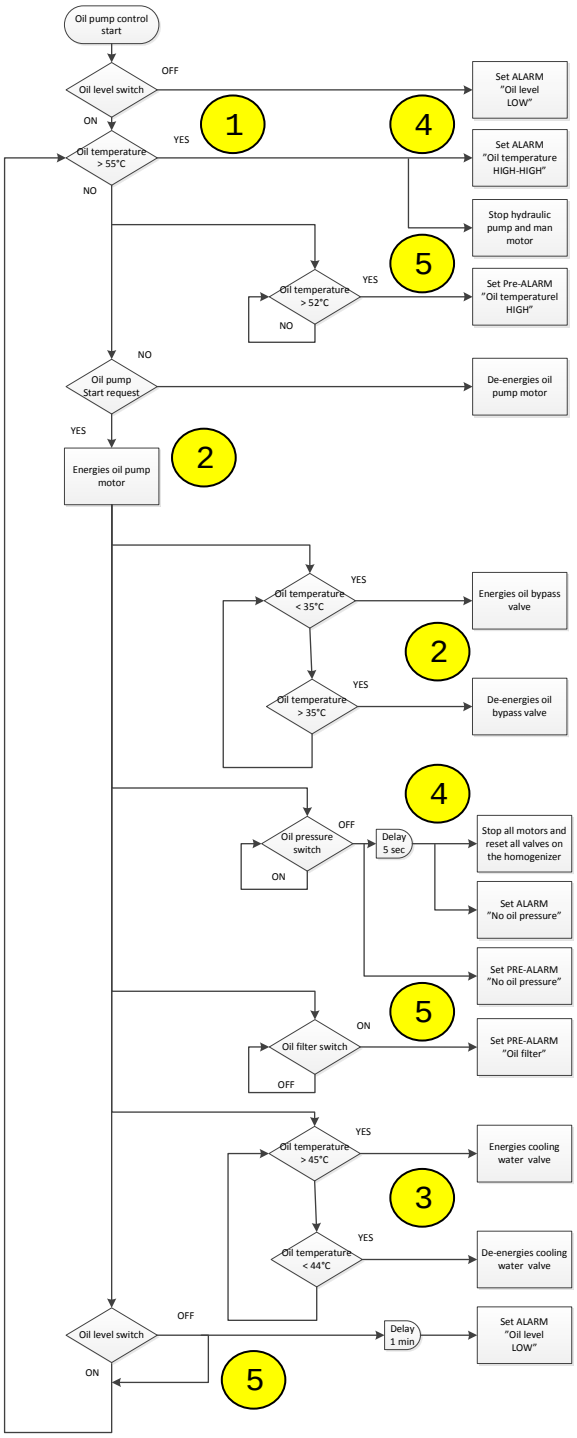
Oil pump eccentric



1 Requirements prior to starting

1.1 Oil level switch ON.
1.2 Oil temperature < 55°C

2 Oil lubrication Pump start/run

2.1 Oil pump start request active
2.2 Oil temperature > 10°C
2.3 Energise oil pump motor for eccentric oil box
2.4 Oil bypass valve:
2.4.1 When eccentric oil temp <35 °C, energise bypass valve for eccentric oil system.
2.5 When eccentric oil temp >35 °C, de-energise bypass valve for eccentric oil system.

3 Eccentric oil cooling system control

3.1 Cooling water valve:
3.1.1 When eccentric oil temp > 45 °C, energise water valve for eccentric oil system.
3.1.2 When eccentric oil temp < 44 °C, de-energise water valve for eccentric oil system.

4 Eccentric oil system alarms stopping the homogeniser

4.1 Oil level low. Machine not running
4.2 Oil temperature HIGH-HIGH.
4.3 No oil flow for more than 5 min.

5 Eccentric oil system alarms (Information)

5.1 Oil temperature HIGH
5.2 No oil flow.
5.3 Oil filter
5.4 Oil level low. Machine running

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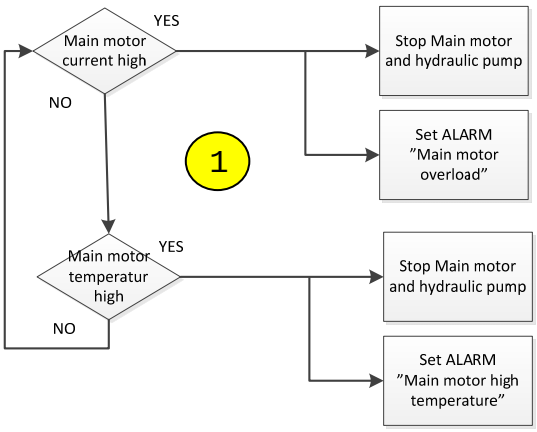
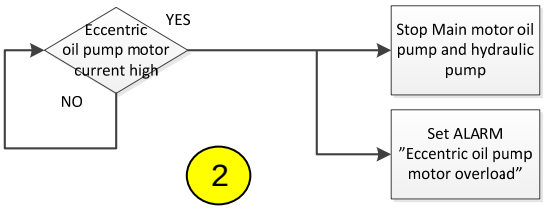
Motor control sequence

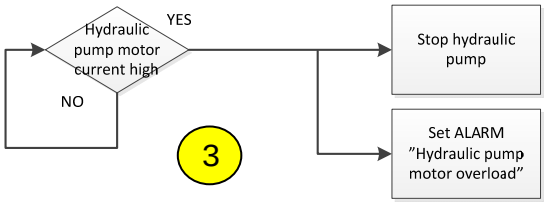
Main motor control sequence



Eccentric oil pump motor control sequence



Hydraulic pump motor control sequence



1 Main motor

- 1.1 Motor current higher than max. motor current
- 1.2 Motor thermistor activated

2 Gear oil pump motor

- 2.1 Motor current higher than max. motor current

3 Eccentric oil pump motor

- 3.1 Motor current higher than max. motor current

4 Hydraulic pump motor

- 4.1 Motor current higher than max. motor current

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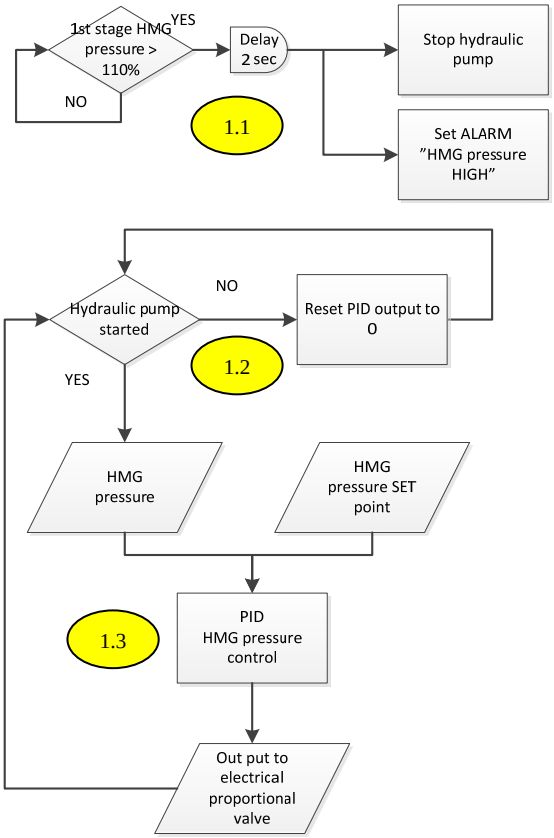
HMG pressure control sequence



1 **1st stage HMG pressure**

1.1 Stop hydraulic pump and set "HMG pressure high, if higher than 110% of machine max. pressure

1.2 If pressure is controlled by a PID controller, the PID output must be zero when the hydraulic pump is not running.

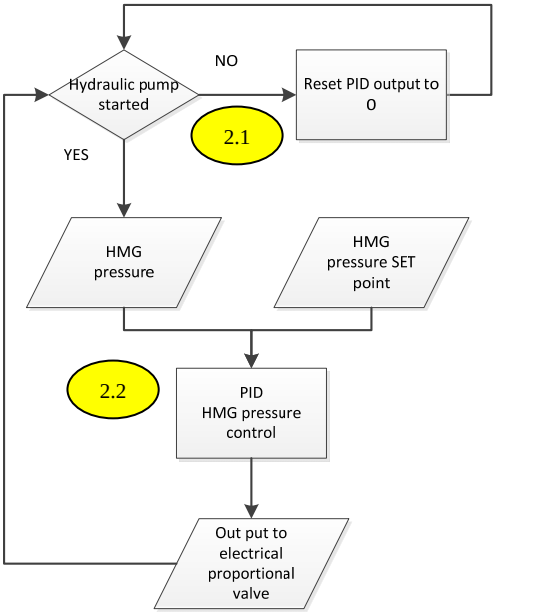
1.3 The PID controlling is based on the actual homogenizer pressure and the required homogenizing pressure

2 **2nd. Stage HMG pressure**

2.1 If pressure is controlled by a PID controller, the PID output must be zero when the hydraulic pump is not running.

2.2 The PID controlling is based on the actual homogenizer pressure and the required homogenizing pressure

2nd stage HMG pressure control sequence



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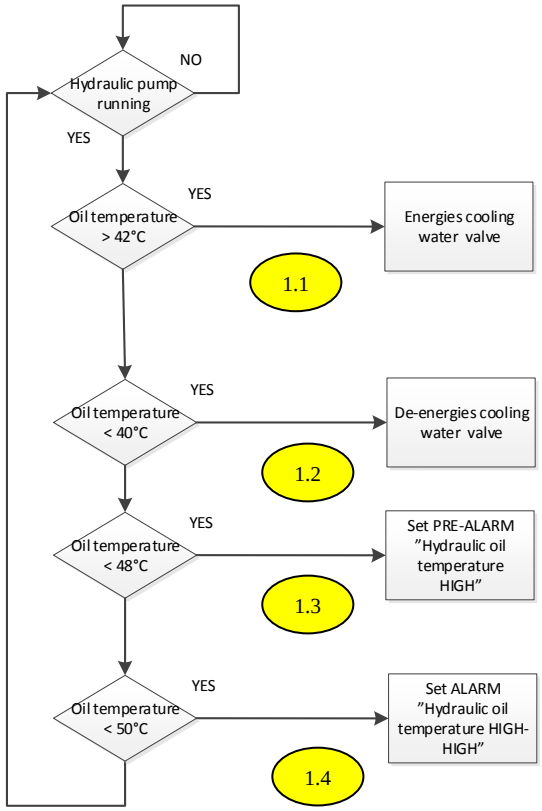
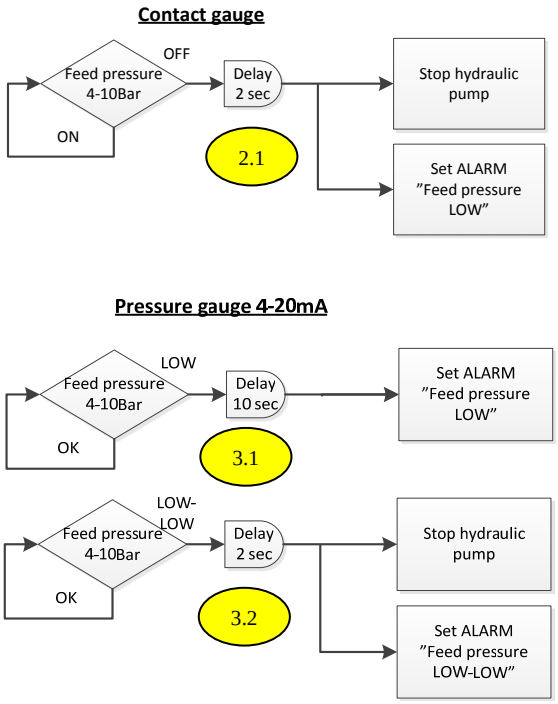
Hydraulic temperature control sequence



Feed pressure control sequence



1 Hydraulic oil temperature control sequence

1.1 Hydraulic oil temp > 42 °C, energise water valve for gear oil system.
1.2 When hydraulic oil temp < 40 °C, de-energise water valve for gear oil system.
1.3 When hydraulic oil temp > 48 °C, energise hydraulic oil temperature pre-alarm.
1.4 When hydraulic oil temp > 50 °C, energise hydraulic oil temperature alarm.

2 Feed pressure (Contact

2.1 If feed pressure is <4 bar and the hydraulic pump is running, the hydraulic pump must be stopped and alarm Feed pressure LOW must be set.

3 Feed pressure (4-20mA)

3.1 If feed pressure is <4 bar and the hydraulic pump is running, the hydraulic pump must be stopped and alarm Feed pressure LOW must be set.
3.2 If feed pressure is <3 bar and the hydraulic pump is running, the hydraulic pump must be stopped and alarm Feed pressure LOW-LOW must be set.

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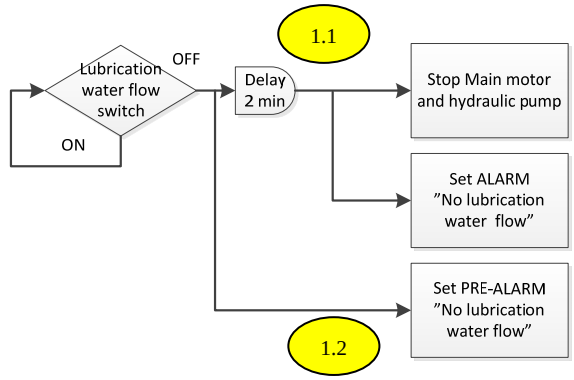
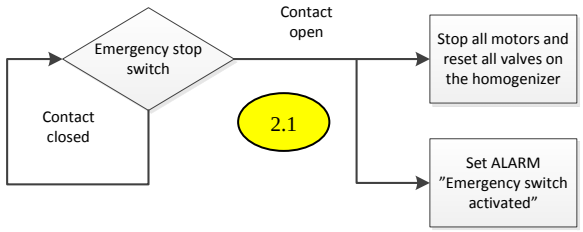
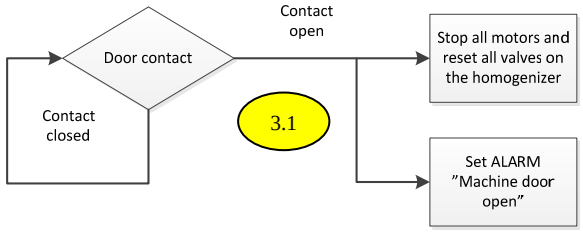
Lubrication water control sequence



Emergency stop control sequence



Machine door contact control sequence



1 **Lubrication water control**

1.1 If lubrication flow is OFF for < 2 min when the main motor is running, the main motor (and hydraulic pump motor if running) must be stopped and PRE-alarm No lubrication water flow must be set.

1.2 If lubrication flow is OFF when the main motor is running, the main motor (and hydraulic pump motor if running) must be stopped and alarm No lubrication water flow must be set.

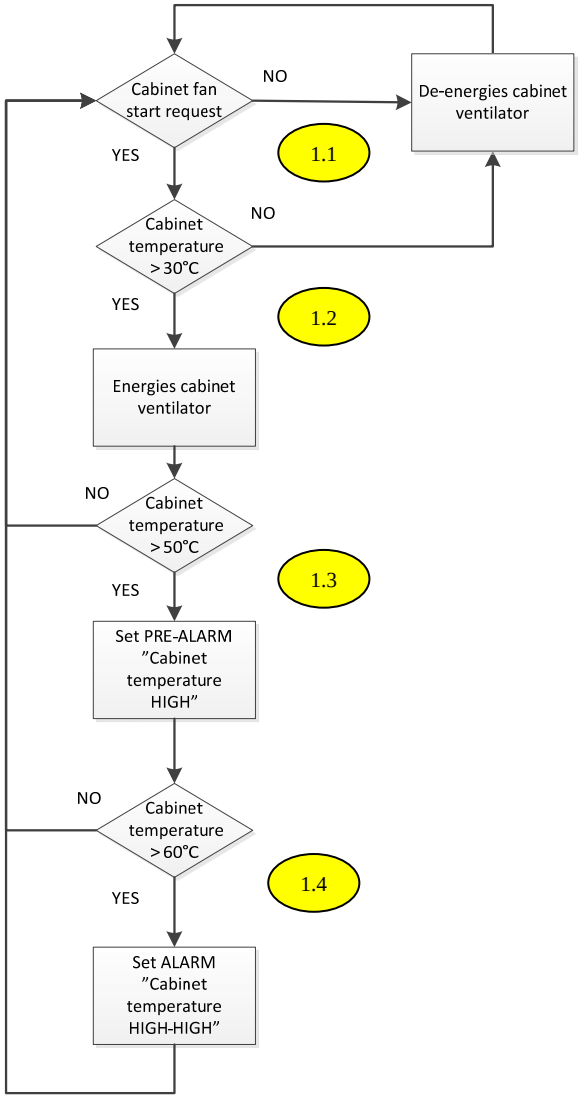
2 **Emergency stop**

2.1 If the emergency stop switch is open, all motors and other hazard equipment on the homogenizer must be stopped and alarm Emergency switch activated must be set.

3 **Machine door contact control sequence**

3.1 If the door contact is open, all motors and other hazard equipment on the homogenizer must be stopped and alarm Machine door open must be set.

Cabinet temperature control sequence



1 **Cabinet temperature control sequence**

1.1 Cabinet temp > 30 °C, energise cabinet ventilator
1.2 Cabinet temp < 30 °C, de-energise cabinet ventilator
1.3 When cabinet temp > 50 °C, Pre-alarm cabinet temperature HIGH must be set.
1.4 When cabinet temp > 60 °C, alarm cabinet temperature HIGH-HIGH must be set.

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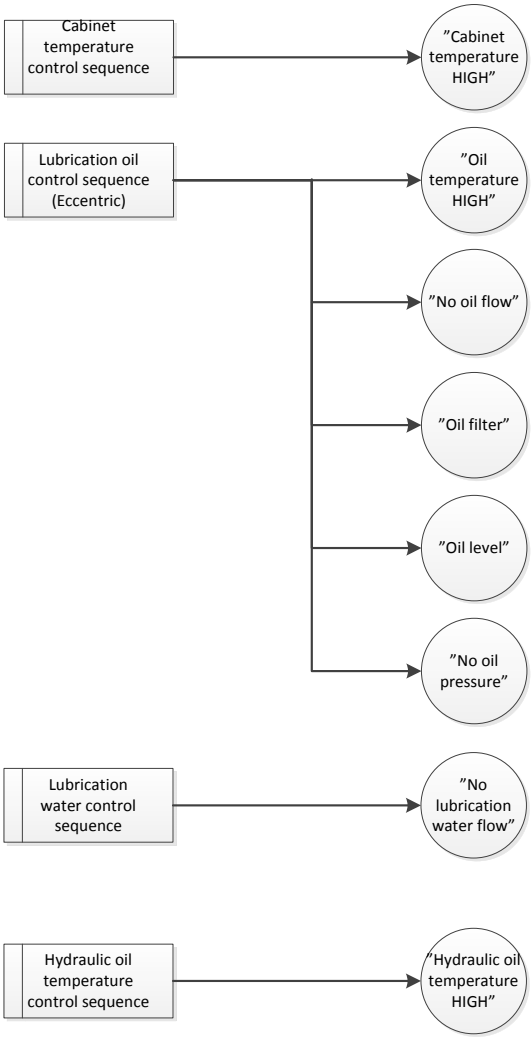
Alarms

There are 3 types of alarms, to be incorporated in the control system.
Some of the alarms are needed (NEED) and some are Nice to Have (NTH) for the machine safety.
Some of the nice to have alarms are not available for standard relay control cabinets to minimise the hardware.

Pre-alarm overview



Type 1 **Pre-alarm inform failure only**

A1.1 (NTH) Cabinet temperature higher than 50 °C

A1.2 (NEED) Oil temperature eccentric higher than 50 °C.

A1.3 (NEED) Oil flow eccentric missing for less than 5 min.

A1.4 (NEED) Oil eccentric filter blocked

A1.5 (NEED) Oil level eccentric low when running

A1.6 (NEED) Oil pressure eccentric missing for less than 5 sec.

A1.7 (NTH) Lubrication water missing for less than 120 sec.

A1.8 (NTH) Hydraulic oil temperature higher than 48 °C.

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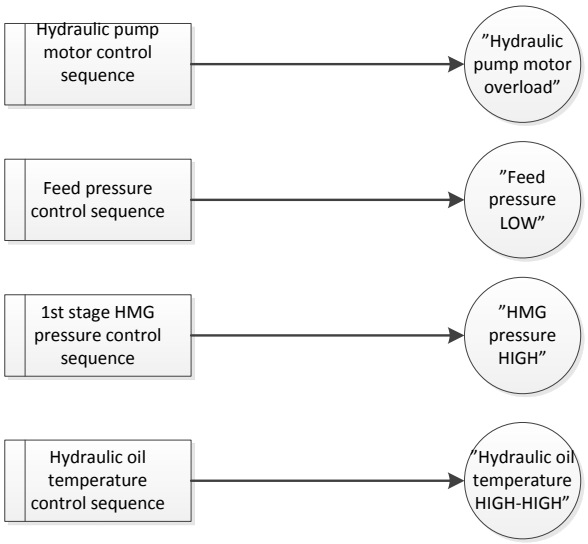
Alarm overview (Stops hydraulic)



Type 2 **Alarms that stop hydraulic pump motor.**

A2.1 (NEED) Hydraulic pump motor overload

A2.2 (NEED) Feed pressure less than sufficient.

A2.3 (NTH) Homogenizer pressure higher than 110 % of max pressure.

A2.4 (NTH) Hydraulic temperature higher than 50 °C.

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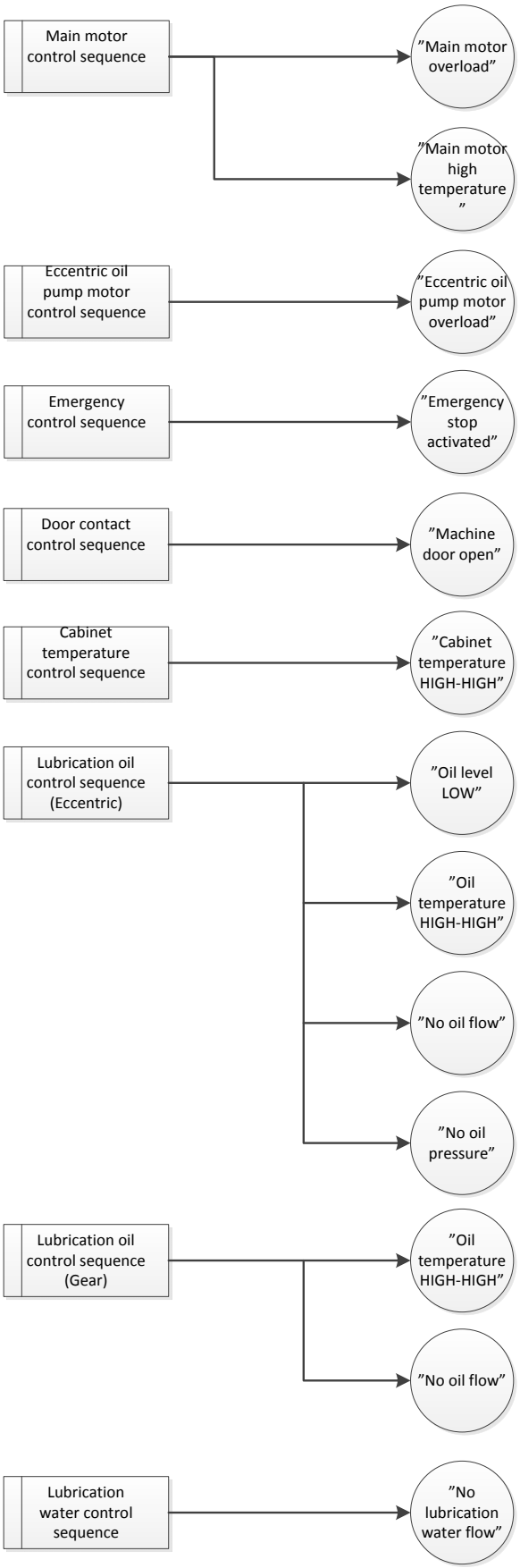
Alarm overview (Stops machine)



Type 3 **Alarm that stops main motor and hydraulic pump motor.**

A3.1 (NEED) Main motor overload

A3.2 (NEED) Main motor thermistor failure.

A3.3 (NEED) Oil pump motor eccentric overload

A3.4 (NEED) Emergency stop switch open

A3.5 (NEED) Machine door open

A3.6 (NTH) Cabinet temperature higher than 60 °C

A3.7 (NEED) Oil level low before starting

A3.8 (NEED) Oil temperature eccentric higher than 55 °C.

A3.9 (NEED) Oil flow eccentric missing for more than 5 min.

A3.10 (NEED) Oil pressure eccentric missing for more than 5sec.

A3.11 (NEED) Oil temperature gear higher than 55 °C.

A3.12 (NEED) Oil flow gear missing for more than 5 min.

A3.13 (NTH) Lubrication water missing for more than 120 sec. (Can be only pre-alarm)

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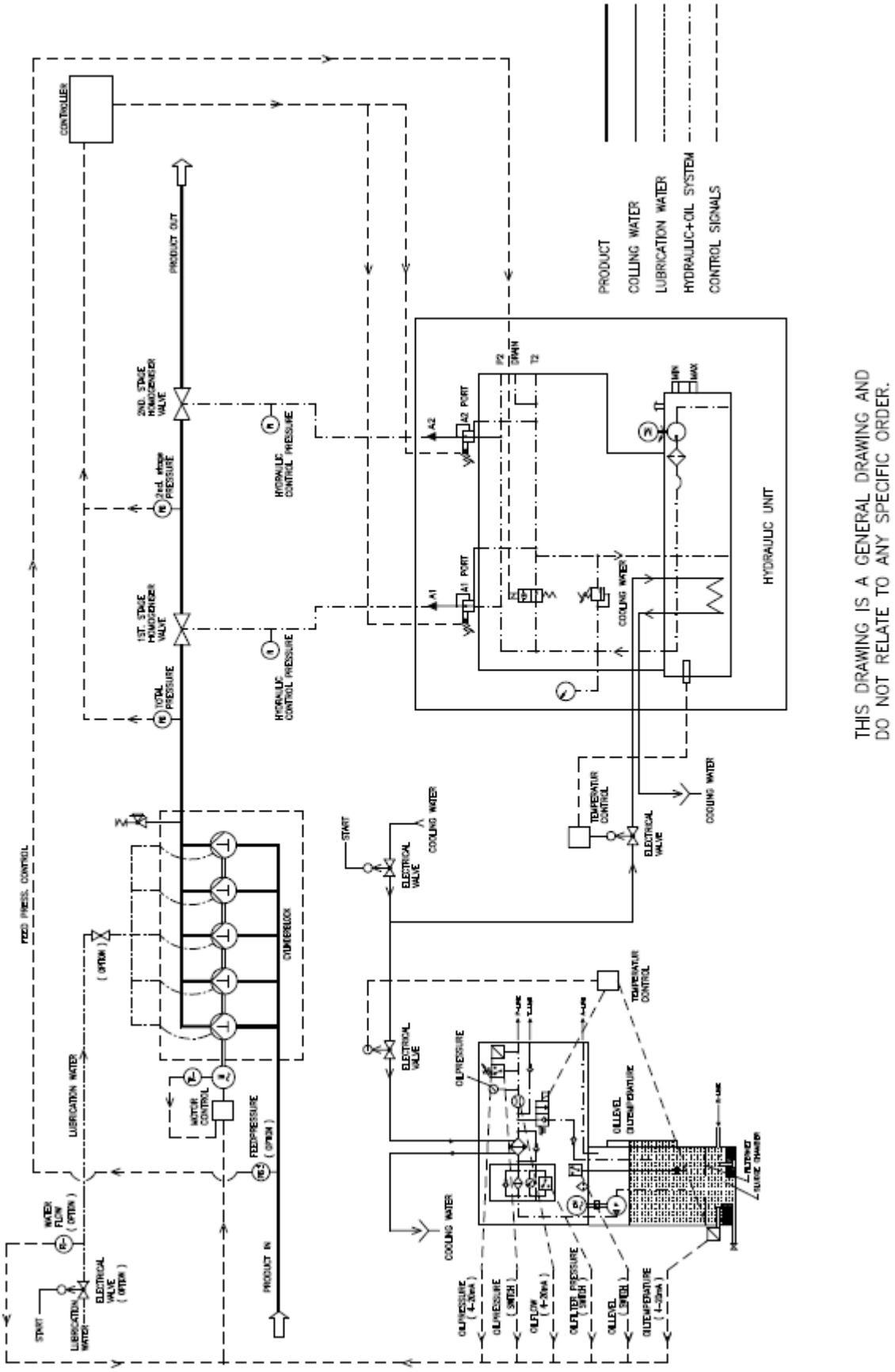
General PID drawing



THIS DRAWING IS A GENERAL DRAWING AND DO NOT RELATE TO ANY SPECIFIC ORDER.