Procedure: Checking Three-Phase Rotation on Newly Installed Machinery

Purpose

Many industrial machines require the correct three-phase rotation to operate properly.
If the phase rotation is incorrect, the machine may appear to be faulty even though it is not.
Common symptoms include motors running backwards, pumps not circulating oil or coolant, alarms on start-up, or the machine failing to operate as expected.

When This Procedure Should Be Used

Carry out this check:

- When a machine is first connected to power
- After relocation or reconnection
- If the machine powers up but does not operate correctly
- If motors appear to be running in the wrong direction
- If a CNC machine displays an alarm on start-up

Safety First

- This procedure applies to **three-phase power only**.
- Electrical work must be carried out by a **licensed electrician** where required by local regulations.
- Do **not** remove covers or access live terminals unless qualified to do so.
- If unsure at any stage, stop and consult a qualified electrician.

What Phase Rotation Means

Three-phase power consists of three active phases.
The **order** in which these phases are connected determines the **direction of rotation** of three-phase motors.

Correct phase rotation = motors rotate in the intended direction
Incorrect phase rotation = motors rotate in reverse

Typical Symptoms of Incorrect Phase Rotation

Incorrect phase rotation may cause one or more of the following:

- Spindle or main motor running backwards
- Hydraulic pump not building pressure
- Lubrication pump not circulating oil
- Coolant pump running but no coolant flow
- Unusual noises from pumps or motors
- **CNC machines displaying alarms or fault messages**

On CNC machines, alarms may **or may not explicitly indicate a phase rotation issue**, even when phase rotation is the underlying cause.

CNC Machines and Alarms (Important)

Many CNC machines perform internal checks on start-up.
If phase rotation is incorrect, the control may generate an alarm related to:

- Hydraulic pressure
- Lubrication flow
- Spindle orientation
- Axis readiness
- Servo or drive faults

These alarms **do not always state that phase rotation is incorrect**, and the alarm text may vary depending on the control manufacturer and machine configuration.

For this reason, **phase rotation should always be checked first** on a newly installed CNC machine before assuming a fault with the machine, control, or drives.

How to Tell if a Motor Is Running in the Correct Direction

Use the following checks to confirm correct rotation. Not all machines will have all indicators.

Motor Rotation Arrow

- Many electric motors have an **arrow on the motor body or fan cover** indicating the correct direction of rotation
- If present, this arrow should always be used as the primary reference
- If the motor is rotating opposite to the arrow, phase rotation is incorrect

Hydraulic Systems

- Machines fitted with hydraulic systems should **build pressure normally**
- If the hydraulic pump is running backwards, pressure may be low or non-existent
- A hydraulic pump running in reverse may also sound different or laboured

Milling Machines – Table Feed Direction

- On milling machines, table feeds should move in the **expected direction** when engaged
- If the table feed direction is reversed or behaves unpredictably, phase rotation may be incorrect

Lathes – Rapid Traverse

- On lathes fitted with rapid traverse, the carriage should move in the **intended direction** when rapid is selected
- If rapid traverse operates in the opposite direction to expected, phase rotation should be checked immediately

---

Method 1: Using a Phase Rotation Tester (Recommended)

1. Ensure the machine is **isolated and powered off**
2. Connect a phase rotation tester to the incoming three-phase supply
3. Restore power and observe the tester indication
4. Confirm the phase rotation matches the tester's "correct" direction
5. If rotation is incorrect, power must be isolated before any changes are made

---

Method 2: Observing Motor Direction (Where Appropriate)

This method should only be used where:

- The machine manufacturer allows it, and
- There is no risk of damage if the motor briefly runs

1. Ensure guards are in place and the area is clear
2. Start the machine briefly
3. Observe motor, spindle, pump, or feed direction
4. Compare operation to arrows, labels, or normal machine behaviour
5. Stop the machine immediately if rotation is incorrect

Correcting Phase Rotation

If phase rotation is incorrect:

1. **Isolate the power supply**
2. Swap **any two phases** at the supply connection point
3. Restore power
4. Recheck rotation using one of the methods above

Only two phases need to be swapped. Swapping all three has no effect.

After Correct Rotation Is Confirmed

Once correct phase rotation is established:

- Recheck machine operation
- Confirm hydraulic pressure where applicable
- Confirm lubrication and coolant flow
- Confirm correct feed and traverse directions
- Clear any CNC alarms and recheck machine status

Important Notes

- Phase rotation is determined by the **supply**, not the machine
- A machine that previously worked elsewhere may still require phase rotation correction at a new site
- Phase rotation issues are common and do not indicate a fault with the machine

---

If Problems Persist

If the machine still does not operate correctly **after phase rotation has been confirmed**, please contact us with:

- Machine make and model
- CNC control type (if applicable)
- Description of the issue
- Any alarm or fault messages displayed