

2G. Machinery

Scope

Machinery refers to an assembly of parts, one or more of which are fitted with a drive system, and which are joined together for a specific application.

Consequently, whilst a pillar drill, or a neutron beam line are considered as pieces of **work equipment**, and all the general parts of this code apply, only those parts of the pillar drill, or neutron beam line, which are powered and can be remotely moved (without direct human effort) are considered to be **machinery**.

Machinery used within STFC includes (but is not limited to): workshop machines (pillar Drills, lathes, milling machines, guillotines etc.); robots; moveable beam line components; and neutron beam line shutters etc.

Safe Machines

Machines are made safe by employing a number of parallel strategies. These strategies are enshrined in the relevant legislation given in Appendix 1A, but an overview of the essential requirements is given below.

1: Prevent access to dangerous parts of machinery

Machinery should be constructed to prevent contact of any part of the body or clothing with any dangerous (moving, sharp, hot or electrically live) part of the machine. This is done by:

- The provision of fixed closing guards; or, if not practicable;
- The provision of other guards or protection devices such as interlocked guards and pressure mats; and
- With workshop machinery it will be necessary to provide appliances such as jigs, holders and push sticks etc.

2: Provide suitable controls including emergency stops

Controls should be designed and fitted such that:

- It is possible to easily identify what each control does, and which equipment it effects.
- Controls and their markings are clearly visible;
- Controls for normal operations should not be placed where anybody using them might be exposed to risk;
- It should only be possible to start, or re-start equipment by using the appropriate controls. (e.g. it should not be possible to restart equipment by simply re-setting a protection device);
- Any change in the operating conditions of equipment should only be possible by the use of a control unless the change does not increase Health and Safety risks;
- Start controls should not be combined with “emergency stop” controls;
- “Hold to run” controls should be designed so that the stop function has priority over the start control following the release of the control; and
- Accidental operation is prevented (e.g. buttons and levers should be shrouded or lockable).

Stop Controls

Operation of a stop control should bring equipment to a safe condition in a safe manner. The stop control does not have to be instantaneous in its action and can bring the equipment to rest in sequence or at the end of an operating cycle if this is required to ensure safety.

Stop controls should switch off all sources of energy from the equipment after it has stopped, if this is necessary to prevent or minimise risks to health and safety. Where internally stored energy could lead to risk, it should be cut off or dissipated by the operation of the stop control.

The stop control should take priority over an operating or start control. Where possible, it should only require a short manual action to activate it, even though the stop sequence once initiated may take some time to complete.

Emergency Stop Controls

Emergency control(s) should be provided where the other safeguards in place are not adequate to prevent risk when an irregular event occurs. However, emergency stops should not be considered as a substitute for safeguarding. Emergency stops should be easily reached and activated but should not be used as functional stops during normal operation.

3: Implement Lock Off and Isolation Procedures

Such procedures should be used to make equipment safe:

- During maintenance;
- When unsafe conditions develop; or
- When a temporary situation (such as a change in environmental conditions) would make it unsafe to use the equipment.

Isolation entails breaking the energy supply in a way that ensures inadvertent reconnection is not possible. For some equipment this could be as simple as removing the plug from the electrical supply, whilst for others an isolating switch or valve may need to be locked in the closed position to avoid reconnection.

Control of Maintenance work

If work on isolated equipment is being done by more than one person:

- Consider providing a locking device with multiple locks and keys. Each person will have their own lock and key, and all locks will have to be removed before the isolating device can be removed.
- Keys should not be passed to anyone other than the nominated people working on the isolated equipment, and they should not interchange keys.
- When equipment contains stored energy, this should be dissipated in addition to effective isolation of the machine before any maintenance or repair work begins.

4: Provide Markings and Warnings

Markings

Markings should be fixed to the machinery as appropriate to indicate the presence of hazards and provide useful information to the user. For example:

- Start and stop controls;

- Safe working loads for lifting equipment & lifting accessories;
- Gas cylinder colour to identify contents;
- Pipe work should be colour coded to indicate contents; and
- Markings are also required to denote the presence of radioactivity or lasers.

Markings may use words, letters, numbers or symbols and as far as possible should conform to published standards.

Warnings and Warning Devices

Warnings or warning devices are appropriate where risks to health and safety remain after other hardware measures have been taken. A warning is normally in the form of a notice or warning device with the intention of reinforcing information, instruction and training, e.g. "Hard hats must be worn".

Warning devices make the extra step and actively warn users of danger. They can be audible or visible, and indicate either imminent danger or the continued presence of a potential hazard.

Warnings must be designed so that they are:

- easily perceived, understood and can be acted on; and
- unambiguous;

Consideration should be given to factors which affect people's perception of warnings and warning devices, especially those indicating imminent danger. Choice of colour or constant or flashing signal can have a different impact in different situations.

Maintain and Inspect

Maintenance and Inspection of Machinery should be carried out in line with the guidance in Appendix 1.