

Nissan Diesel Engineering Manual DEM

Issue No. DW2-71001-E
Issued on 8 May 1996

Discussed by: Unit subcommittee

Name: Safety Standard for divisions of machining and assembling

Summary

This standard describes standard to protect human from dangerous area of facility

Draft

Applicable

1. This standard is applicable to all facilities of machining divisions and assembling divisions, excluding production support divisions at workshop, of all plants of Nissan Diesel Motor
2. This standard is applicable to all the new facilities. For the current facilities, it is applied to according to prioritized sequence.

This standard should be go together with "Safety Standard of Facility Construction Standard" (DE1-51002-E).

この原文(和文)には、文意が明確に理解できない箇所がありました。近い将来、原文を含め、校正と見直しが必要です。---訳者 2008/11/7

Index

I . Operation of facility

1. Operation of facility ----- 2

II . Control circuit

1. Push button switch ----- 4
2. Power source selector switch ----- 5
3. Mode selector switch ----- 6
4. Operation preparation circuit ----- 7
5. Complete stop button ----- 8
6. Emergency stop wire ----- 9
7. Alarm device ----- 12
8. Short circuit breaker ----- 14
9. Inter lock circuit ----- 16
10. Hydraulic operation circuit ----- 17
11. Hydraulic accumulator circuit ----- 20
12. Air pressure operation circuit ----- 21

III . Heating device

1. Abnormal temperature detecting function ----- 22
- Explanation ----- 23

I Operation of facility

1. Operation of facility

1-1. Applicable scope

This is to stipulate safety standard to be prepared for facility, when an operator does following jobs on all machines;

- a. to set and remove work to and from machine
- b. to do job inside the machine
- * Change over
- * Tool change (includes when tools are located at the starting point as well as at the other in operation positions)
- * Inspection and repair of facility

This safety standards consist of those which are defined as case by case and those which are prioritized for adoption.

1-2. Safety standards

(1) Safety standard is prescribed on the condition as operation preparation ON, start operation OFF when work is at setting and removing off.

- * Structure should be so constructed as to prevent operator's hands irrespective of on or off duty being pinched by jigs or other fixtures.
- * In case that it is necessary for operator to put his or her hand into facility at setting and removing off work, area sensor or interlock lid which is provided in the area should stop operation of the facility.
The circuit needs not to shut down operation preparation.

(2) Safety standard in case of operator to carry out operation in the facility (changeover, exchange tool, inspection, repair) The alphabet indicates priority for adoption.

(Change over)

- a. Should be carried out at operation off and facility shut down all
- b. For the facility which needs hydraulic pressure, electricity, change over selector switch should be provided on the main control panel. The switch should be ON.

In this situation other buttons which are not necessary for change over should not be effective. Also it should be mentioned on the sign board that "... parts is operative during change over."

- c. Operating part of facility during change over should have safety cover.
- d. * Facility should be so constructed as to give easy operation posture for operator for change over.
 - * Weight of parts for change over should be 5kg for single hand and 15kg for both hands, if standing position is provided and no crouching is required.
 - * Parts for change over should be the shape of easy handling.

(Tool exchange)

- a. Should be carried out at facility shut down all
 - * Main shaft of drilling machine should be quick change holder.
 - * Construction allows to exchange tools by manually operating the handle which is applied to main shaft motor.
 - * Selector switch should be provided on the main control panel for exchange tools of transfer machine. Circuit of following operation should be adopted: When the switch is selected to exchange tools and both unit return buttons are pressed, whole units move backwards and hydraulic circuit stops.
- b. Operating part of facility during exchange tool should have area sensor.
- c. For the facility which needs hydraulic pressure, electricity, selector switch should be provided on the main control panel. The switch should be ON.

In this situation other buttons which are not necessary for exchange tool should not be effective. Also it should be mentioned on the sign board that "... parts is operative during exchange tool."

- d. Operating part of facility during exchange tool should have safety cover.

(Inspection and repair of facility)

- a. Should be carried out at facility shut down all

II. Control circuit

1. Push button switch

1-1. Applicable scope

This is to prescribe required safety conditions for push button switches of facilities for safe operation.
(relevant regulations: Occupational Health and Safety Regulation, articles 103, 104, 107, 108 and 332)

1-2. Specification standard

- (1) All push buttons which start to operate any part of machine should be embedded type in order not to start operation unintentionally by touch of any part of body.

NB: Embedded button means switch cannot be on unless the button is pressed deeper than the guard ring. (Fig.1-1)

* Distance between two buttons to be pressed by both hands simultaneously should be 250mm or more measured at the nearest guard rings.

* Select push button should not be used for ON-OFF switch for rotating operation.

- (2) Stop all operation button and emergency return button are used to provide safety in emergency situation. Therefore they should be mushroom type or mushroom similar type for easy pressing.

NB: Mushroom type or mushroom similar type buttons are those which have operation point higher than guard ring and wider top surface for easy pressing.

(See Fig.1-2, Fig.1-3)

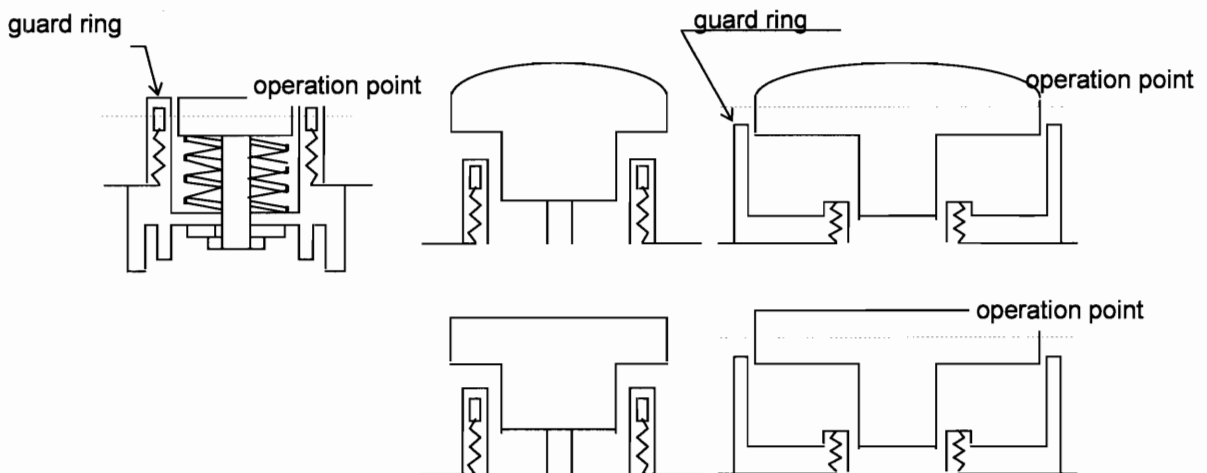


Fig.1-1
Embedded type
press button

Fig.1-2
Mushroom type
press button

Fig.1-3 Mushroom
similar type press
button

2. Power source key switch

2-1. Applicable scope

Power source key switch is installed to prevent sudden start of operation by the third party by chance in order to provide safety for person engaged in repair or tool replacement etc. by stopping the facility.

This paragraph describes the requirement for the switch.

2-2. Installation standard

Power source key switch should be as a rule installed all the facilities.

2-3. Specification standard

(1) Power source should be on or off by the power source key switch.

(2) Power source should have 2 positions; left side off, right side on.

Key can be removed from the switch only at off position. (Fig. 2-1)

(3) When the switch is turned to off position, all the push buttons of the facility should be inoperative.

(4) Power source key switch should be installed on the main control panel.

(5) A lamp should be installed to indicate main circuit is operative, even when the key is removed from the facility.

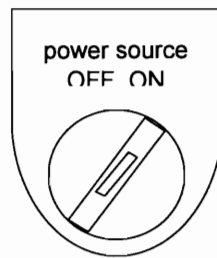


Fig. 2-1 Power source key switch

3. Mode selector switch

3-1. Applicable scope

This paragraph describes the requirement of mode selector switch fitted to facility with automatic cycle operation.

3-2. Specification standard

- (1) Mode selector switch can be used only for selecting circuit. Operation of the switch should not make any part of the facility operative.
- (2) When mode selector switch is operated during automatic operation of the facility, it should not stop operation until completing the cycle of operation.
- (3) Interlock should be provided to prevent to turn on electricity to other circuit simultaneously when mode selector switch select one circuit.

Example of circuit (Fig. 3-1)

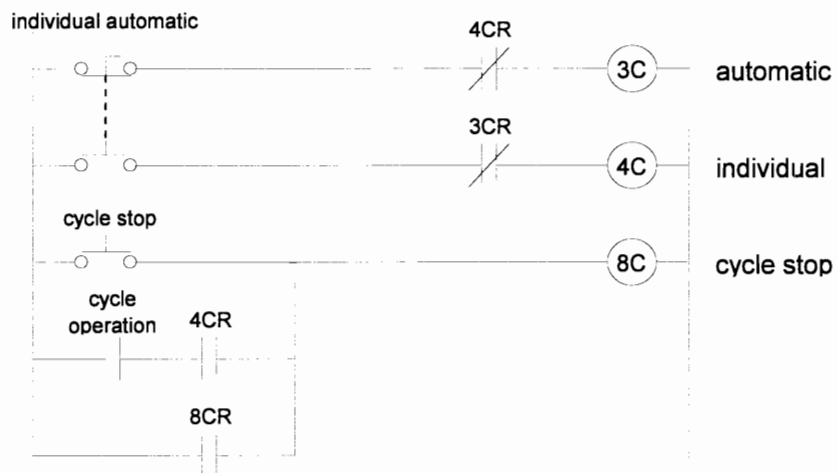


Fig. 3-1 Example of interlock switch

4. Operation preparation circuit

4-1. Applicable scope

This paragraph describes operation preparation circuit on all facilities with control circuit.

4-2. Specification standard

- (1) Operation preparation button should be a lamp button which lights when turned on.
- (2) Operation preparation circuit should have emergency holding circuit which enables to hold the state of operation in case of emergency stop.
- (3) Operation preparation circuit should be located at the base of whole circuit. When the circuit turns off, whole the circuit should be turned off.

Example of circuit (Fig. 4-1)

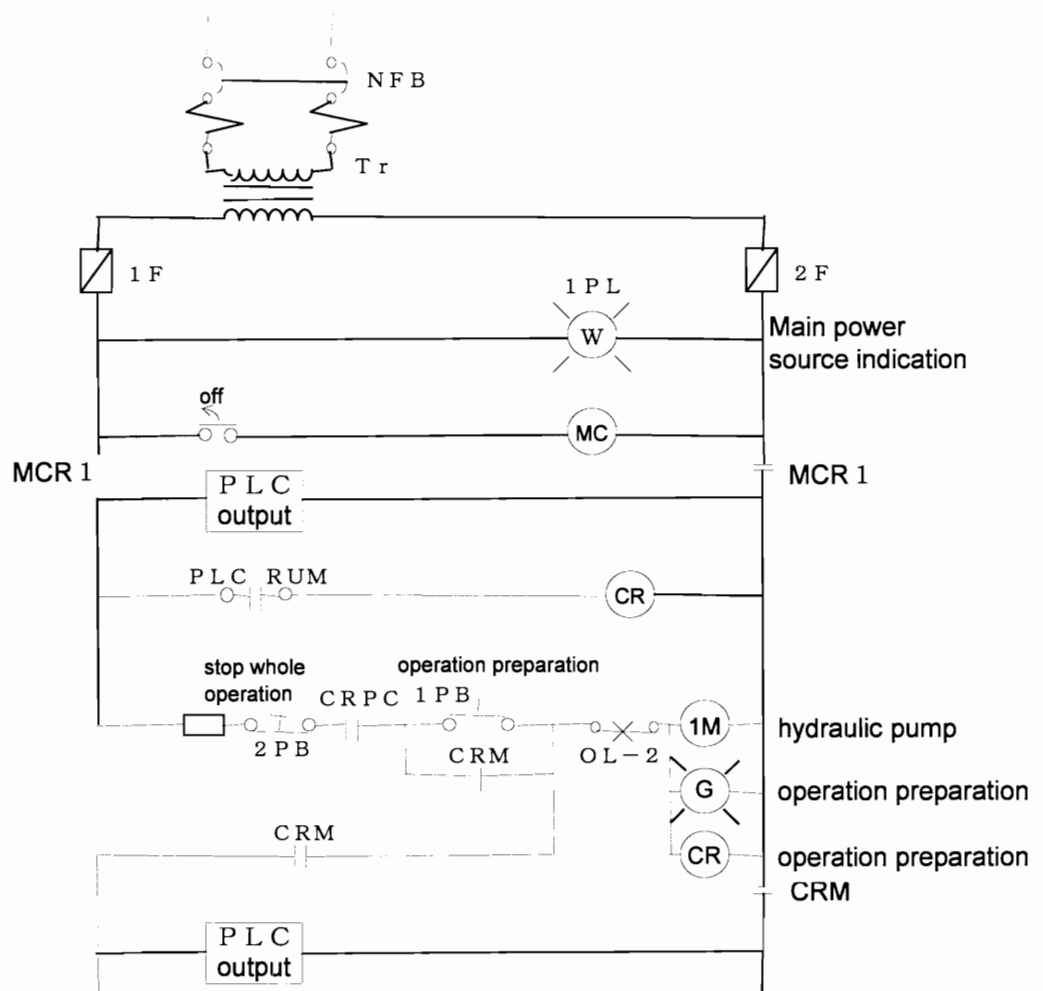


Fig. 4-1 Example of operation preparation circuit

5. Shut down all button

5-1. Applicable scope

This paragraph describes requirement of all shut down button the purpose of which is to make emergency stop of the facility.

5-2. Installation standard

Shut down all button should be located so as to be able to operate immediately at emergency.

5-3. Specification standard

- (1) When shut down all button is pressed, control circuit is shut down, all the driving components stop at the position and driving source (hydraulic unit, compressed air etc.) should be stopped or cut off.
- (2) Shut down all button should be operative at any operating condition of the facility.
- (3) Shut down all button should have normally closed contact in the circuit so as to operate safety side in case of disconnection occurs in the circuit.
- (4) Shut down all button should be red colour and mushroom type. (Size should be 40mm diameter or more and push lock turn reset type.)
- (5) Restart after complete shut down cannot be available unless all the abnormality are corrected.

Example of circuit (Fig. 5-1)

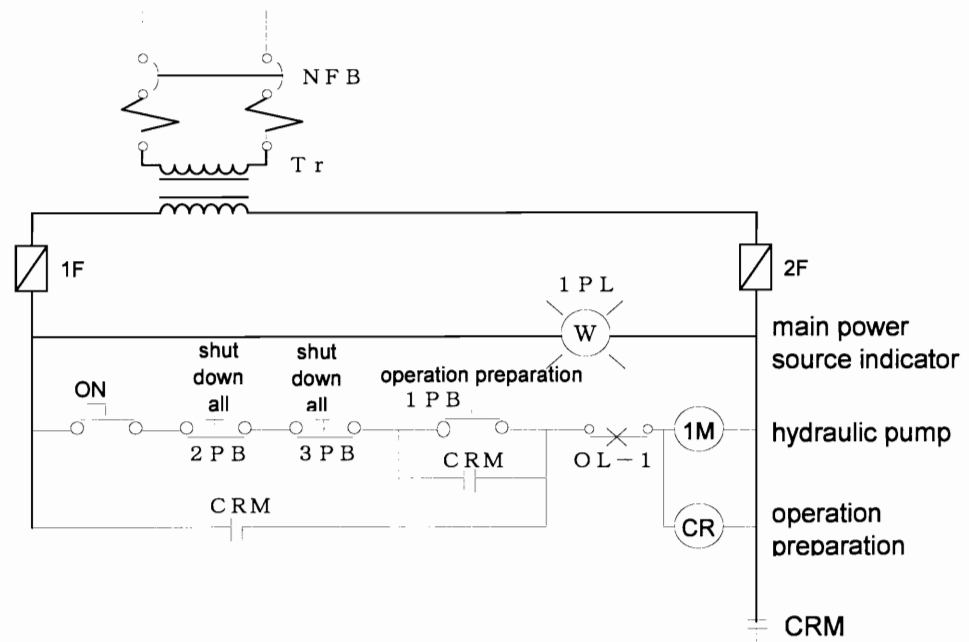


Fig. 5-1 Example of circuit with shut down all button

6. Emergency stop wire

6-1. Applicable scope

This paragraph describes requirement of emergency stop wire to stop operation of facility in case of emergency. The system covers vast area of operation.

6-2. Installation standard

Emergency stop wire is not required if shut down all button can cover the function of emergency stop.

This should be provided only for the case where some area cannot be covered by shut down all button or is difficult to prepare safety cover.

6-3. Specification standard

- (1) Pulling the emergency stop wire should operate the limit switch to stop whole operation of facility as same as pushing shut down all button.
- (2) Limit switch used for emergency stop wire should have function to keep operative and not return to non operative situation automatically once wire is pulled.
- (3) State that emergency stop wire is operative should be indicated on the sign board.
- (4) Emergency stop wire should stop operation of facility by detecting disconnection and slack of the wire.

Example of circuit (Fig. 6-1)

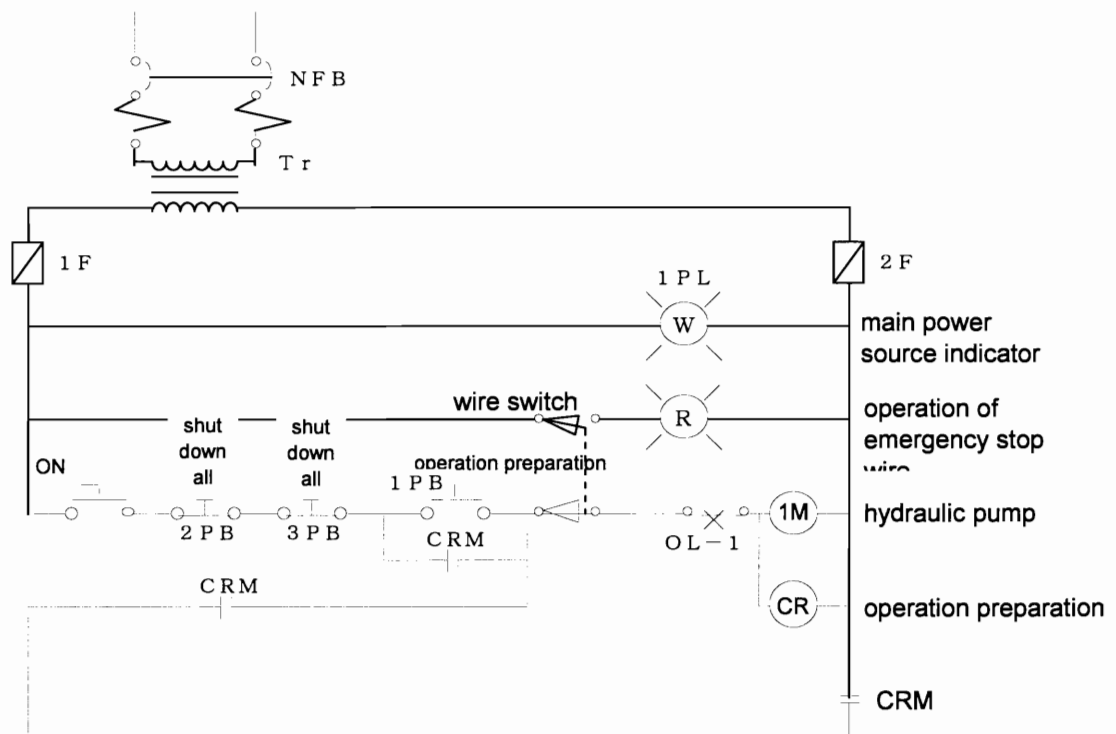


Fig. 6-1 Example of circuit of emergency stop wire

- (5) For emergency stop wire, wire described in Steel wire JIS G 3525-73 (wire rope) No.3 6x19 diameter 4 is used coated with red colour vinyl chloride or nylon.
- (6) The end of the wire should be firmly fixed with two wire clips. (Fig,6-2)

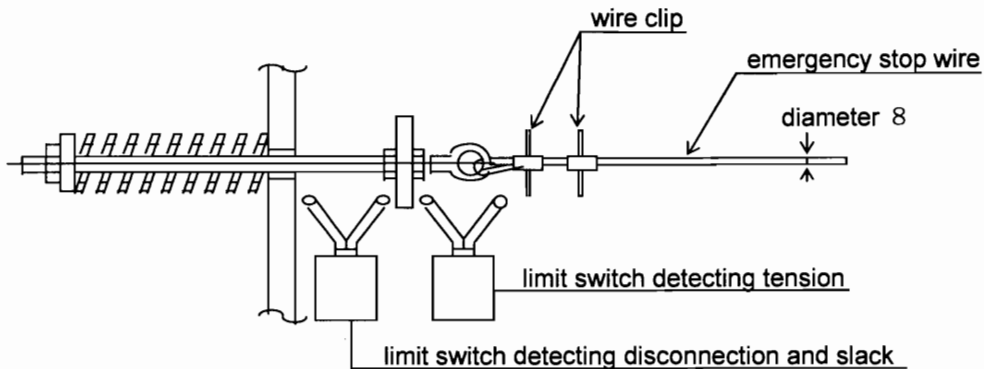


Fig. 6-2 Detecting system of emergency stop wire

- (7) Emergency stop wire should operate at the stroke of 150mm or less.
In case it does not operate within 150 mm stroke, wire should be separated.
- (8) Emergency stop wire should operate at the pulling force of 5 to 15 kgf (49 to 147 N) at any location.
- (9) Emergency stop wire should be located at the height of 1,500 to 1,800 mm from top surface of operating floor. Also the height should be suitable for operating emergency stop.
- (10) It is not preferred to have many bending points on the wire as it makes to need more force to pull the wire.
- (11) Guide roller or wire support should be located around 4,000 mm pitch.

[Supplement] Emergency return button

1. Applicable scope

This paragraph describes emergency return button and temporary stop button.

The purpose of those button is to avoid facility breakdown and give troublesome recovery operation caused by complete shutdown (stop operation on the spot by cut off of control circuit or driving source) of the facility

2. Standard for installation

Emergency return button should be located where it can be operated immediately when emergency occurs.

However shut down all button should be prioritized and those buttons are located symmetry on the panel.

3. Specification standard

(1) All the operating units should return back to the original position. (Control circuit and driving source are not shutdown.) In this situation only shutdown all button and abnormality reset button are effective. Other operation must be inoperative.

However loader and carrying equipment should stop on the spot.

(2) Emergency return button should be effective at independent mode.

(3) Emergency return button should be open contact point.

(4) Emergency return button should be yellow mushroom type.

(5) Recovery procedure after emergency return

After completion of abnormality reset operation, automatic cycle should be reactivated by pressing cycle operation button.

However tool does not return to the original point of machining, cycle operation should become ready when the tool returns to the point.

7. Alarm device

7-1. Applicable scope

This paragraph describes alarm device which is installed to inform dangerous state to operators and other people around there by sound or light.

7-2. Installation standard

- (1) Facility of automatic operation which is large in size and may cause some dangerous situation around should equip with alarm device.

Example: transfer machine, trolley conveyor, automatic assembling machine, chip conveyor

- (2) Facility of automatic operation, where it caused dangerous situation by movement of the facility and safety measure is not available, should have device to inform alarm for approaching..

Example:

Example: stacker crane, autorun, automated guide vehicle etc.

- (3) Alarm should be provided where dangerous situation may occur.

Example: when tray is carried out of furnace etc.

7-3. Start up alarm

- (1) At the first start up of facility after operation termination and returning back to energy saving circuit, when start button is pressed, facility should start after alarm sounds for 3 seconds or more
- (2) In this situation, button should be continuously pressed until facility starts, or if pressing the button is released during alarm sounding, the alarm should stop sounding and facility should not start.

Example of circuit (Fig. 7-1)

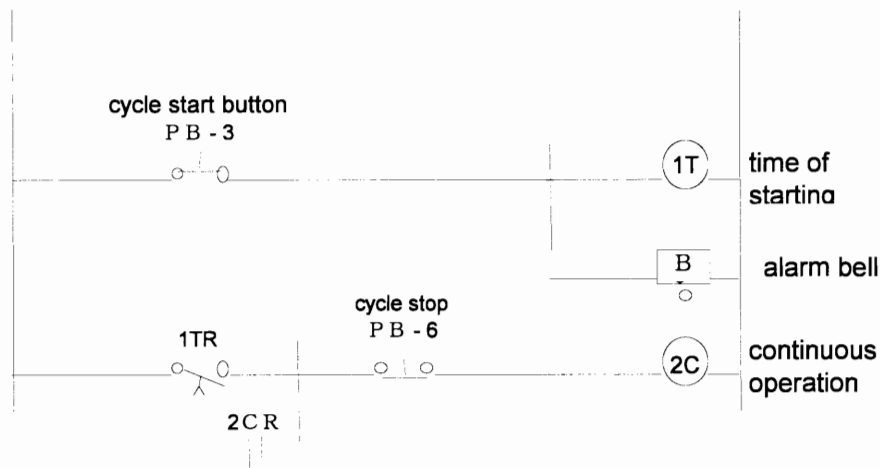


Fig. 7-1 Example of start up circuit

7-4. Specification standard

- (1) Start up alarm should be acoustic such as bell, buzzer, horn etc.
- (2) Approaching alarm and danger alarm should be both sound and rotary beacon.
- (3) Sound level of acoustic alarm should be higher than background noise by around 5 phon.
- (4) It is preferred to equip many alarms of low level noise to only one with high noise level.
- (5) Facility direction and location should be decided so as to be covered alarm sound.
- (6) Rotary beacon should be yellow light and have size of around 150 mm diameter.

8. Ground-fault circuit interrupter

8-1. Applicable scope

The regulation demands ground-fault circuit breakers to keep safety of operators in case of ground-fault. This paragraph describes ground-fault circuit breaker for machining operation.

8-2. Circuit where ground-fault circuit breaker should be equipped

- (1) Electrical circuit to supply electricity to facility which uses voltage of 200 volts or higher
- (2) Electrical circuit to supply electricity to mobile facility which uses voltage of 150 volts or higher
- (3) Electrical circuit located in moist environment and to supply electricity to facility which uses voltage of between 60 and 150 volts or higher

[NB]

These circuit breakers are located to each individual circuit separately to prevent power interruption to other related circuit. (high voltage facility, induction hardening etc.)

8-3. Selection of ground-fault circuit interrupter

Should be selected according to the table in 8-1.

8-4. Installation of ground-fault circuit interrupter

Facility with outside handle should be installed.

種 別	定格感度電流	定格動作時間	備 考										
変電設備所の配電用遮断器	1,000 ~ 2,000mA	4S	中感度時延形 低感度時延形 (設備保護)										
幹線分岐遮断器 動力分電盤分岐遮断器	100 ~ 500mA <table border="1"> <thead> <tr> <th>遮断器 フレーム</th> <th>定格感度 電流</th> </tr> </thead> <tbody> <tr> <td>50A</td> <td>100mA</td> </tr> <tr> <td>100A 225A</td> <td>200mA</td> </tr> <tr> <td>400A以上</td> <td>500mA</td> </tr> </tbody> </table>	遮断器 フレーム	定格感度 電流	50A	100mA	100A 225A	200mA	400A以上	500mA	0.3S~1S	中感度時延形 (設備保護)		
遮断器 フレーム	定格感度 電流												
50A	100mA												
100A 225A	200mA												
400A以上	500mA												
負荷設備の主遮断器	30 ~ 500mA(注) <table border="1"> <thead> <tr> <th>遮断器 フレーム</th> <th>定格感度 電流</th> </tr> </thead> <tbody> <tr> <td>30A</td> <td>30mA</td> </tr> <tr> <td>50A</td> <td>100mA</td> </tr> <tr> <td>100A 225A</td> <td>200mA</td> </tr> <tr> <td>400A以上</td> <td>500mA</td> </tr> </tbody> </table>	遮断器 フレーム	定格感度 電流	30A	30mA	50A	100mA	100A 225A	200mA	400A以上	500mA	0.1S以下	高感度高速形 中感度高速形 (感電保護)
遮断器 フレーム	定格感度 電流												
30A	30mA												
50A	100mA												
100A 225A	200mA												
400A以上	500mA												
照明分電盤分岐遮断器 下記1~3の設備用遮断器 1. 移動形、可搬形機器 2. 工事用電源 3. コンセント	30mA(注) (浴室内コンセント は、15mA)	0.1S以下	高感度高速形 (感度保護)										

表 8 - 1 漏電遮断器の選定

9. Interlock circuit

9-1. Applicable scope

In case when interlock is prepared at safety fence, safety door, area sensor, safety matt etc.

9-2. Specification standard

この項の原文の内容が特に難解のため、識者の advice に基づき英訳した。 --- 訳者

- (1) When safety door, safety cover is opened or area sensor operates, facility should be shut down completely.
- (2) Depending upon characteristics of facility, emergency return or temporary stop might be adopted considering safety and operation manoeuvrability. (In this case available area of emergency return and temporary should be mentioned on the chart.)
- (3) Interlock should be effective at both automatic and individual.
- (4) Limit switch for interlock equipped to safety door and safety cover should be open circuit type and should close when door is closed. (Circuit example Fig. 9)
- (5) Safety plug for interlock should be of the type that it is operative when plugged in.
- (6) Safety door and area sensor should have notice board that says when it is opened during facility operation, whole facility will stop.

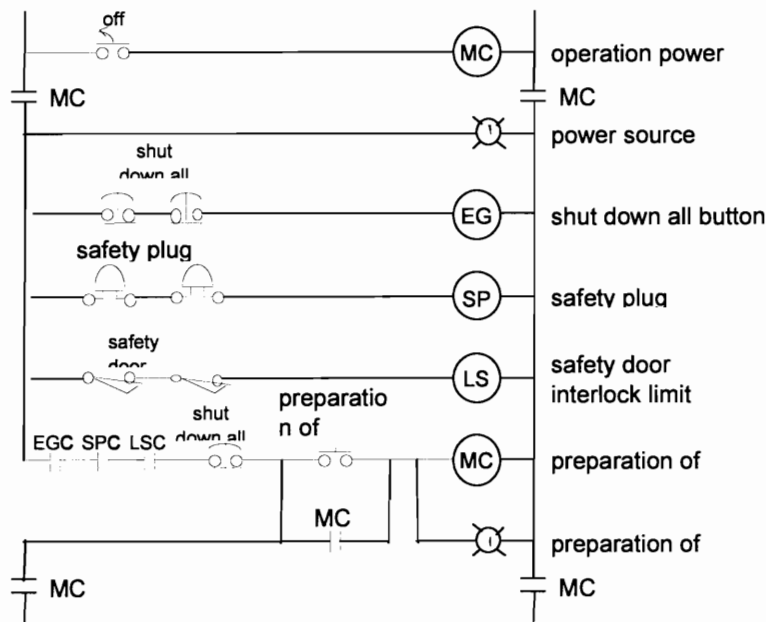


Fig. 9-1 Interlock circuit

10. Hydraulic circuit

10-1. Applicable scope

This paragraph describes hydraulic operation circuit.

10-2. Specification standard

(1) Hydraulic clamp for machining

In order to prevent moving (falling off) of work caused by unclamping due to sudden electric power interruption, system to keep clamping through machining period even at electric power supply cut off should be adopted.

(Example of circuit)

a) Combined use of double solenoid 2 position valve and check valve

(Fig. 10-1)

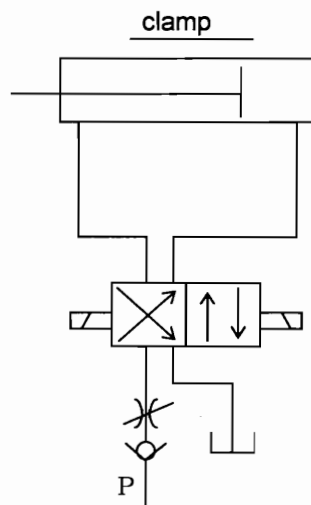


Fig. 10-1

b) Use of 3 position spring centre A, B port block valve

(Fig. 10-2)

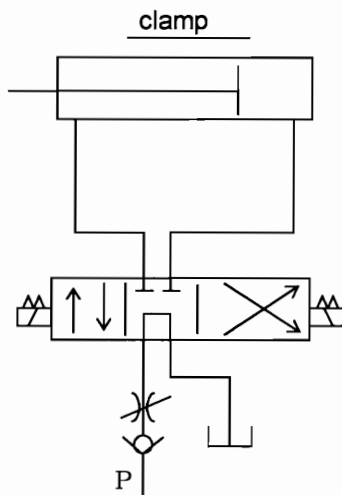


Fig. 10-2

c) Combined use of position spring centre P port block valve and pilot check valve

(Fig. 10-3)

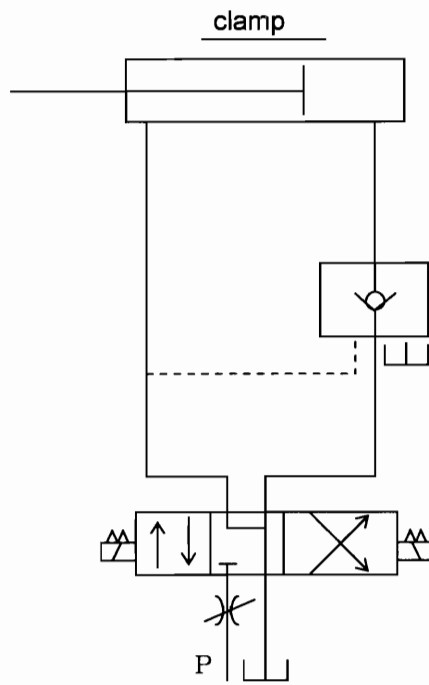


Fig. 10-3

d) Use of spring clamp

(Fig. 10-4)

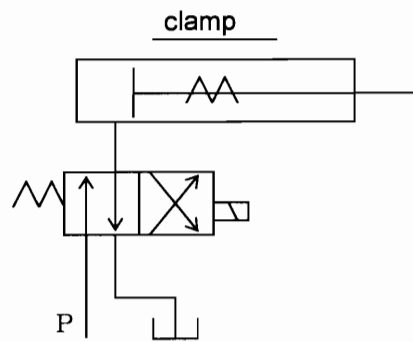


Fig. 10-4

11. Hydraulic accumulator circuit

11-1 Applicable scope

This paragraph describes hydraulic circuit of facility using hydraulic accumulator.

11-2 Specification standard

- (1) Facility should not operate by the remained hydraulic pressure at accumulator after shut down all.
- (2) At shut down all, pressure at accumulator should be blocked and pressure at accumulator should be dropped.

(Fig. 11-1)

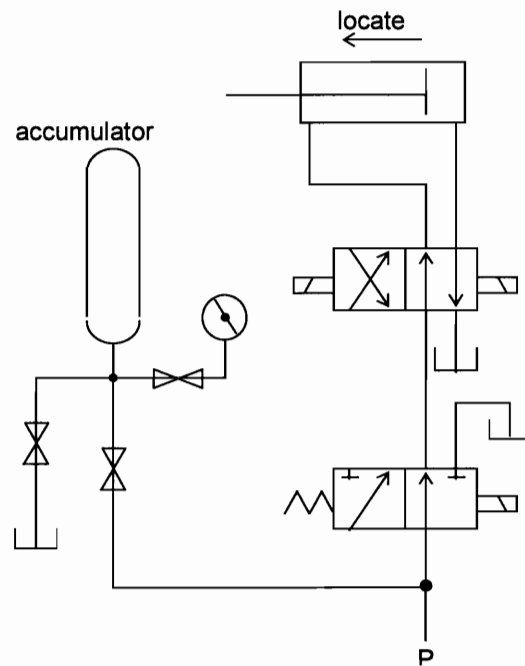


Fig. 11-1 Example of hydraulic accumulator

12. Pneumatic operation circuit

12-1. Applicable scope

This paragraph describes pneumatic circuit of facility operating by compressed air.

12-2. Specification standard

- (1) Facility should not operate by the remained pressure after shut down all. Device to prevent falling off should be provided for facility with vertical operation.
- (2) At shut down all, source pressure should be blocked off and pressure in actuator and air motor should be vent to the atmosphere preferably automatic.

If it is not possible, manual vent valve should be provided. The valve should have label to indicate manual valve to release remained pressure.

Circuit diagram (Fig. 12-1)

- (3) Vertical unit and air clamp operated by compressed air should be able to vent remained pressure manually by providing cylinder with brake etc.
- (4) When operating stroke is 100 mm or more
In order to avoid pinching of operator' hand or so, if stroke of clamp is 100 mm or more, the clamp should be stop on the spot at electric power supply interruption or emergency shut down.
If device has operation of jumping out at recovery, prevention circuit should be prepared.

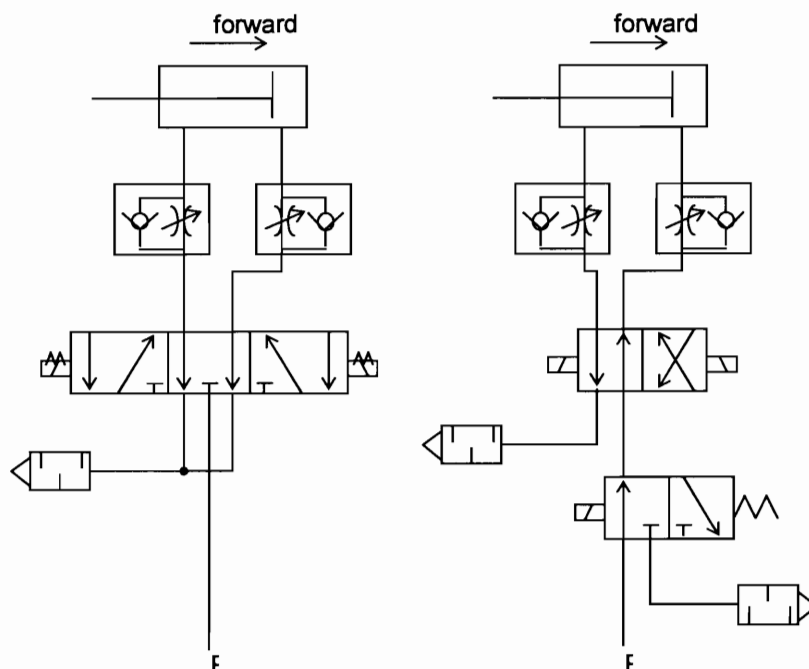


Fig. 12-1 Example of releasing remained air pressure circuit

III. Heating device

1. Abnormal temperature detecting function

1-1. Applicable scope

Applicable to facility with heat source which has following conditions.

- a. Facility which can decide heating temperature arbitrary
- b. Facility which can decide target temperature automatically controlled.

Following facility is excluded.

- Facility without fire as heat source...induction hardening, vapour heating etc.
- Manual operation facility or facility attended by operator all the time...core manufacturing

Applicable facility should have abnormal temperature detecting function (overheat interlock co

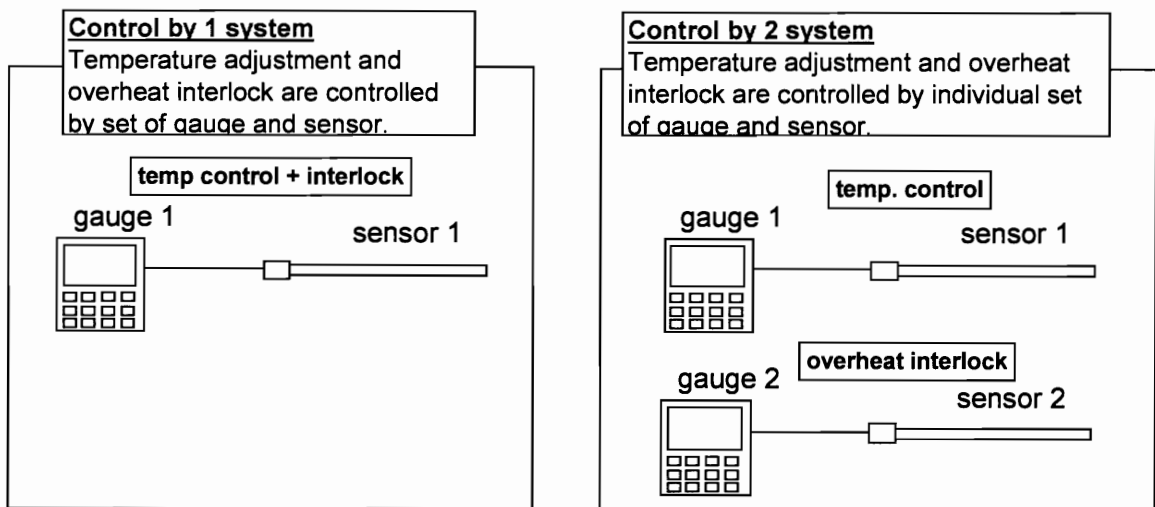
1-2. Safety standard

- (1) If facility falls into any one of the square with round mark in the below table, the facility should have D control system and overheat interlock.
- (2) Even though heated material is non flammable, attaching oil may catch fire. Therefore overheat interlock of any of from A to D should be provided.
- (3) In case though heated material is restricted to water or washing liquid, overheat interlock is not needed.

制御方式	過熱インターロック	
	警報	警報+加熱源強制停止
1系統	A	B
2系統	C	D

systems of 2 or more are included in 2 system.

<Control system>



<Operating condition>

区分	内容	加熱源	
		ガス	電気
加熱方式	直接加熱	○	○
	間接加熱		
可燃性雰囲気	有り	○	○
	無し		
常用温度	100°C未満		
	100°C～400°C未満		
	400°C～1000°C未満	○	○
	1000°C以上		
被加熱物	不燃性製品(カム, クランク, ギア, シャフト等)		
	可燃性製品(塗装製品)	○	○
	可燃性液体(焼入れ油等)		
	不燃性液体(水, 洗浄液等)		

解説

1. 制定の主旨

1) 設備操作編

DEM機械加工分科会として「設備構成基準」「電気構成基準」「操作制御盤基準」「塗装色基準」「提出書類基準」等により、機械設備製作における安全基準が定められている。

しかし、これらの設備を使用する場合の操作上の安全基準が無いため、ここに作成し、DEMとして制定する。

- ① 機械設備を人に介在して使用する場合、定常作業、不定常作業にかかわらず、人の安全が確保されている事。
- ② 設備の安全な確保する為の施策としては、作業性を無視した方法でなく、生産性も合わせて向上する安全策を採用する。
- ③ 安全上最悪の事態を想定して、設備を全停止させる手段(非常停止釦)を作業者の所定位置近くに設置する。

2) 制御回路編

制御回路に対する安全基準は設備構成基準に含まれているが、安全関係をここにまとめ、安全基準としての位置づけを明確にした。

3) 加熱設備

異常温度検知に関する基準が無いため、過熱による火災防止の観点からDEMを制定する。

[配 布 先]

*印 特別配布

J 1 4
* J 1 D A
J 1 D B
J 1 D F
J 1 D H
E 1 3
E 1 4
E 1 5
E 1 6

[改 定 内 容]

加熱設備に関する、異常温度検知機能の基準を追加制定した。

制 定	: 1995年 5月 1日	日産ディーゼル工業(株)DEM委員会
改 定	: 1996年12月19日	ユニット分科会 分科会長:小玉 信太郎
改 定	: 2007年 6月29日	

審議分科会 : ユニット分科会
専門委員会 : ユニット専門委員会

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この基準に意見または質問があれば、J 1 Bへ連絡して下さい。