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A HUMAN ENGINEERING GUIDE TO THE ARRANGEMENT OF ELEMENTS ON A CONTROL PANEL

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ABSTRACT

This memorandum is a compilation of general information concerned with the arrangement of elements on a control panel. Arrangement considerations that lead to improved ease and accuracy of operation are presented to assist the engineer in designing new control panels.

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INTRODUCTION

In the design of a new control panel the arrangement of panel elements involves many considerations of a conflicting nature. Of paramount importance is an arrangement of panel elements such that the operator's task is simplified to the greatest possible extent and possible sources of errors in operation or in observing indications are reduced to a minimum. This memorandum is a compilation of general information concerned with the arrangement of elements on a control panel. It should not be considered as a set of principles to be followed rigidly under all circumstances, but rather as a list of considerations which the engineer should call to mind as he is faced with the task of designing a new control panel.

ELEMENTS OF A CONTROL PANEL

In this memorandum, a control panel is assumed to include any or all of the following elements:

1. Controls. These include panel elements such as knobs, toggle switches, levers, cranks, push buttons, and the like, manually set by the operator.
2. Indicators. These include panel elements such as meters, clocks, panel lamps, dials, etc. to be observed by the operator.
3. Labels. These consist of identifying markings for all elements of the control panel as well as suitable markings to indicate switch positions.
4. Cable receptacles. These consist of electrical connectors for attaching power-supply cables to the panel and for interconnecting the control panel and associated equipment.

CONSIDERATIONS FOR LOCATION OF PANEL ELEMENTS

The following considerations for location of panel elements may, and frequently will, require some compromise by the design engineer as some considerations will conflict with others. For example, an important principle in panel design requires that indicators having critical functions occupy the most prominent position with reference to the line of sight, whereas another principle requires that related indicators be grouped together. A situation such as this would call for some compromise on the part of the design engineer. It may also be that a panel design which is ideal from the operator's viewpoint conflicts with what the equipment designer is able to do mechanically or electrically, and again a compromise arrangement is in order.

Location of Controls

For ease and accuracy of operation of panel controls they should be located so that:

1. Uncomfortable operator positions are avoided.
2. The operator is not required to cross his hands when operating two controls simultaneously.
3. The control most likely to be operated with the right hand is in the center or on the right side of the panel.
4. The control most likely to be used with the left hand is on the left side of the panel.
5. There is sufficient distance between controls to minimize the possibility of inadvertent operation.
6. The control is as close as possible to the associated indicator.
7. The indicator being adjusted is not obscured by the operator's hand.
8. The most natural control-indicator relationship is obtained.
9. The control to be operated with the right hand is below or to the right of the associated indicator.
10. The control to be operated with the left hand is below or to the left of the associated indicator.
11. The control which is frequently used immediately after another control is next to it unless there is reason for the operator to have both hands participate alternately or simultaneously in the sequence.
12. The controls are arranged in a logical sequence of operation. For example, the arrangement of the controls so that they are operated in order from left to right results in a logical sequence of operation.
13. The most frequently used controls are the most accessible.
14. The arrangement of the controls is consistent with the arrangement on other panels which the same operator may use.
15. Not more than two controls of the same shape are located side by side.

Location of Indicators

To minimize the possibility of errors in observing indications, the control panel indicators should be located so that:

1. The most important indicator is in the most prominent position with reference to the line of sight. (The most prominent position is normally in the upper center position of the panel.) Warning lights associated with critical functions are located as near as possible to this position and always within +30 degrees of the normal line of sight.
2. The indicators which must be watched continuously are near the center of the control panel.
3. The indicators are readable from the normal head position of the operator, allowing for normal head rotation.
4. The indicators most frequently used are in a group so as to minimize eye movement distance in shifting from one indicator to another.
5. Extremely oblique viewing angles are avoided. Viewing angles up to 45 degrees are considered satisfactory, provided the required information is not obscured and loss in reading accuracy due to parallax is not excessive.
6. The sequence of observations is logical. For example, the arrangement of the indicators so that they are observed in order from left to right results in a logical sequence of observation.
7. The arrangement of indicators is consistent with the arrangement on other panels which the same operator may use.

Location of Labels

The labels associated with the elements of a control panel should be located so that:

1. They are not obscured.
2. The wording is horizontal for quick and easy reading.
3. The names of related elements located adjacent to each other are combined on a strip name plate.
4. The labels are immediately adjacent to the elements they identify.

Location of Cable Receptacles

To ensure that cables connected to the control panel do not complicate the operator's task the panel receptacles should be located so that:

1. The cables do not obscure indicators or labels and do not interfere with normal operation of controls.
2. The cable receptacles are at a sufficient distance from one another so that previously connected cables do not interfere with the cable connecting operation.
3. The cable connecting operation proceeds in a logical sequence.

RECOMMENDATIONS

It is recommended that the design engineer study carefully the considerations presented in this memorandum. When undertaking the design of a new control panel the engineer should review this information and, after completing the initial arrangement of the elements, use this memorandum as a check list. It is recognized that conflicts may exist and the design engineer must make some compromises, but, in following the recommended course of action, the design engineer will be aware of any compromises which may be necessary and will be in a position to make such compromises on a logical basis. The end product, it is believed, will be a better designed control panel.

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