IS 9694-2 (1980): Code of practice for the selection, installation, operation and maintenance of horizontal centrifugal pumps for agricultural application, Part 2: Installation [MED 20: Pumps]

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(Reaffirmed 2001)

Indian Standard

CODE OF PRACTICE FOR THE SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF HORIZONTAL CENTRIFUGAL PUMPS FOR AGRICULTURAL APPLICATIONS

PART II INSTALLATION

1. Scope — Lays down the general guidelines for the installation of horizontal centrifugal pumps for agricultural applications.

2. Shipment

2.1 Special conditions of delivery should be the subject matter of an agreement between the manufacturer and the user. It is important to mention that the pump equipment coming out of the factory should be fully equipped, ready for use, with stuffing box packing, coupling halves mounted or keys fitted on the shaft end.

2.2 Following are the suggested precautionary measures to be taken for protecting all the internal parts of the pump including the enclosures:

a) Bearings should be lubricated or protected by a film of oil;

b) Machined parts exposed to atmosphere should be protected against rusting by a protective film of liquid; and

c) Opening of pipes, pipe flanges and nozzles should be protected suitably by flange covers or by screwed plugs, etc.

2.3 The shipment is usually carried out at the risk of the consignee. It is therefore important that the buyer carries out the following suggested verifications carefully:

a) Inspect and check the material to be delivered and notify to the carrier the damages, missing items, etc, if any;

b) Check the inventory of the equipment with the help of the despatch notes and drawings; and

c) Make sure that all the accessories handed over for transport as well as the necessary tools are present and intact.

2.4 Usually the pump and its prime mover which are meant to be stored are prepared by the manufacturer, in agreement with the user in such a way that they retain their mechanical condition during and after storage time. The user will therefore make sure that the specified precautionary measures have been taken and they are still effective. If it is not so, or in case of delayed use of unprotected pumps, precautionary measures should be taken to protect the equipment. Following are the suggested precautionary measures:

a) The pumpset should be kept in a dry place which is not subject to vibrations;

b) The openings of the pipes and stuffing boxes should be effectively protected to prevent dust or any foreign particles getting into them; and

c) Bearings should be properly lubricated.

3. Installation — Many of the operating difficulties related to the pumps occur due to faulty installation. The following factors come into play in the installation of a pump:

a) Location,

b) Foundation,

c) Alignment,

d) Grouting, and

e) Piping

Pumps Sectional Committee, EDC 35; Horizontal Spindle Pumps Subcommittee, EDC 35 : 2 [Ref : Doc : EDC 35 (3394)]

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3.1 *Location* — Correct location of a pump is important for operating as well as for maintenance purposes. As far as possible, the pump should be located close to the source of water when suction lift is present. This in turn, will minimize the suction lift and permit the use of short direct suction piping. The pump should be placed in an accessible place, so that one can easily inspect the glands, bearings, etc, during operation. Centrifugal pumps require little attention but the attention required is very essential to the life of the pump. Sufficient headroom should be made available where there is a need to employ cranes, etc. Pumps should be generally located in a dry place.

3.1.1 In order to avoid the formation of air pockets and the risk of unpriming resulting there from, the suction pipe shall have a slope constantly rising to the pump. If the diameter of this pipe is greater than the pump suction branch size, the connection has to be made by means of an eccentric pipe.

The pump should be installed in a well ventilated pump house with enough space round about the pumpset for easy approach for inspection and maintenance.

3.2 *Foundation*

3.2.1 A rigid foundation into the ground is normally required for installing a pumpset, unless it is to be mounted on a rigid structured platform. It should be suitable to provide a permanent rigid support for the baseplate for taking the weight of the set, and should have enough mass to absorb any vibrations. The surface area of the foundation should be of sufficient dimensions so as to leave adequate space of sufficient width, around the pumpbase when installed on it, to allow for grouting the foundation bolts, etc. The depth of the foundation depends on the nature of the soil in which it is to be laid.

3.2.2 Continuous concreting should be done as far as possible for laying the entire block of foundation, leaving provisions for grouting and pockets for locating foundation bolts in proper position. It should be provided with double reinforcements, which should not be less than 50 kg/m^3 of concrete. The minimum diameter of the bars should be 12 mm and the maximum spacing should be 200 mm in order to take care of shrinkage in concrete. (*See also* IS : 2974-1968 Code of practice for design and construction of machine foundations — Part IV For Rotary type machines of low frequency).

3.2.3 The size and number of foundation bolts for each pumpset depend on its kW rating and type of prime mover used. For horizontal agricultural centrifugal pumpsets with prime movers of 1 5 kW to 11·0 kW, foundation bolt diameter normally varies from 12 to 20 mm and length from 150 to 450 mm.

3.2.4 Before placing the pumpset with its monoframe base (in case of monosets) or baseplate (in case of direct coupled sets) on the concrete foundation, it is recommended to chip off its upper surface for ensuring perfect adhesion of the grout. Moreover, water should be sprayed on the foundation before pouring the grout. The pumpset should be placed on the foundation with its foundation bolts in position, making it rest on shims and/or wedges placed at frequent intervals (close to foundation bolts position) between the baseplate and concrete block, to provide sufficient space for grouting.

3.2.5 When the pumpset is installed on a platform, constructed inside an open dug well for reducing pump suction lift or for some other reasons, it should be ensured that main supporting wooden beams or steel structures are of suitable size for the required span between their supports and rigid and strong enough to take the weight of the pumpset and two/three men, as also for absorbing vibrations, if any, likely to be caused by the running of the pumpset.

3.3 *Grouting*

3.3.1 Grouting prevents lateral movements of the pumpbase, increases its mass to reduce vibrations and fills in irregularities in the foundation. Normally, grout is composed of one part pure portland cement and two parts building sand, with sufficient water to flow freely under the base. In order to reduce settling, it is recommended to mix the grout and let it stand for a short period and then remix it thoroughly before use. If required, more water may be added.

3.3.2 Before starting grouting work, the pumpset should be levelled properly, with the help of a spirit level, by adjusting the thickness of the shims and/or positions of the wedges, on which it is resting on the concrete foundation block. After satisfactory levelling, foundation belts should be tightened initially by hand. It is recommended that a frame work should be built around the pumpset base. Now the grout is poured until the entire space under the base is filled to the top of the underside. A stiff wire should be used through the grout holds to work the grout in and release air pockets. In order to prevent cracking due to rapid drying, the exposed surfaces of the grout should be covered by wet burlap. The frame work should be removed and exposed surfaces of the grout and foundations finished smooth only after ensuring that the grout is sufficiently set. After 72 hours or more, the hold down foundation bolts should be finally tightened.

3.4 *Alignment (For Coupled Pumpsets)*

3.4.1 Flexible type couplings are used for connecting the shafts of the pump and its prime mover and for transmission of power to the pump. The purpose of the flexible coupling is to compensate for temperature changes and to permit end movement of the shafts without interference with each other while transmitting power from the driver to the pump. A flexible coupling should not be used to compensate for misalignment of the pump and driver shafts. The following are the two forms of misalignment between the pump shaft and the driver shaft:

a) Angular misalignment — Shafts with axes concentric but not parallel, and

b) Parallel misalignment — Shafts with axes parallel but not concentric.

3.4.2 The couplings are to be mounted on the pump shaft and prime mover shaft. The pump and the prime mover should be mounted on the baseplate in such a way that the faces of the couplings are parallel to each other and are spaced far enough so that the coupling/shaft ends cannot strike each other. The minimum dimension for the separation of the coupling used is usually specified by the manufacturer. This dimension may vary approximately from 3·0 to 6·0 mm. The tools for checking the alignment of flexible couplings are a straightedge or a set of feeler gauges. For accurate jobs dial gauge is also used.

3.4.3 A check for angular alignment is made by inserting the taper gauge or feelers at four points between the coupling faces and comparing the distance between the faces at four points spaced at 90 degree intervals around the coupling (*see* Fig. 1). The unit will be in angular alignment when the measurements show that the coupling faces are the same distance apart at all points.

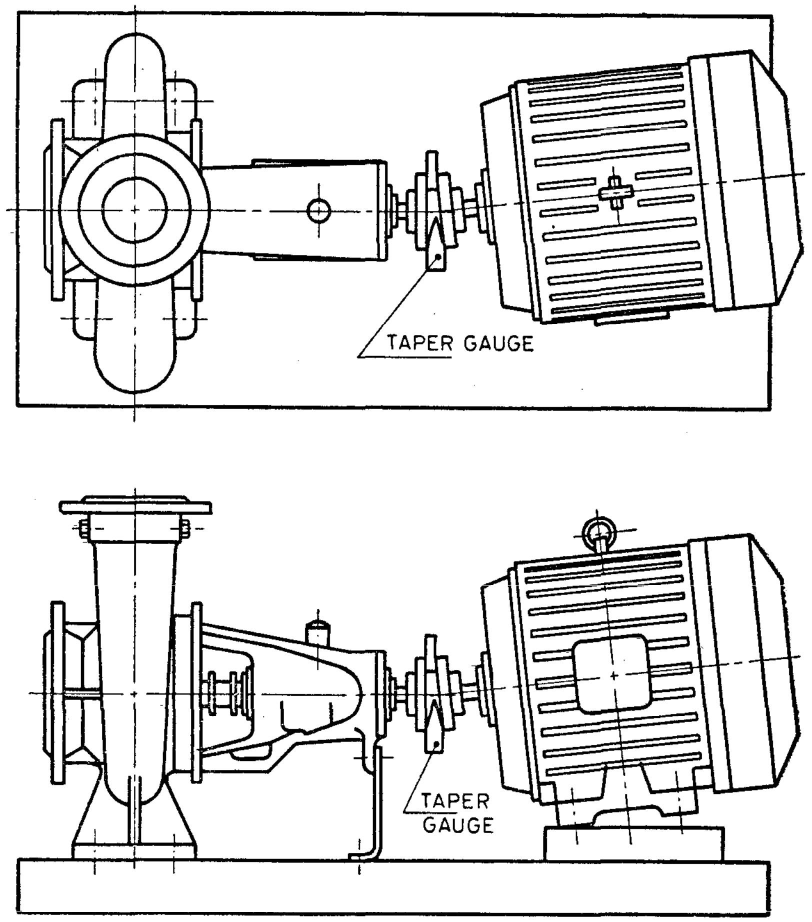

FIG. 1 CHECKING ANGULAR ALIGNMENT

3.4.4 A check for parallel alignment is made by placing a straightedge across both coupling rims at the top, bottom and at both sides (*see* Fig. 2). The unit will be in parallel alignment when the straightedge rests evenly on the coupling rim at all positions. Allowance may be necessary for coupling halves that are not of the same outside diameter. Care must be taken to have the straight edge parallel to the axis of the shafts.

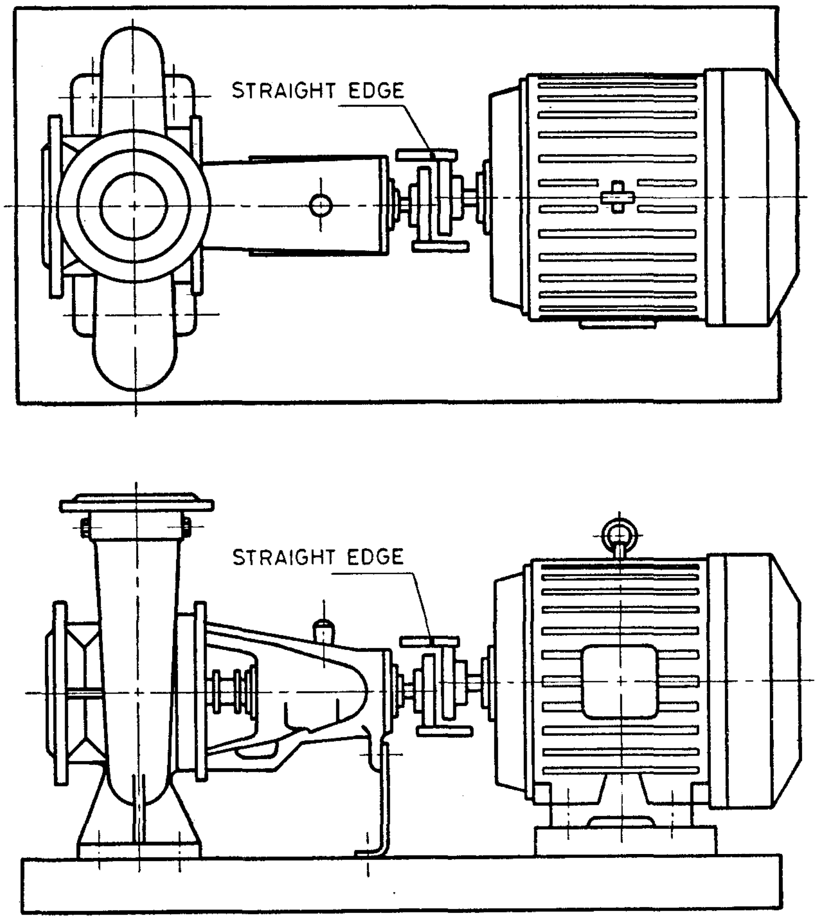

FIG. 2 CHECKING PARALLEL ALIGNMENT

3.4.5 Angular and parallel misalignment are corrected by means of shims under the motor mounting feet. After each change, it is necessary to recheck the alignment of the coupling halves. Adjustment in one direction may disturb adjustments already made in another direction. It should not be necessary to adjust the shims under the pump.

The permissible amount of misalignment will vary with the type of pump and driver. The manufacturer's recommendations should be obtained and followed.

3.4.6 Only after both the halves of the couplings are aligned by making their side faces exactly parallel to each other and their top circular faces in line with each other as mentioned above, the coupling bolts with their rubber bushes should be inserted in coupling bolt holes.

3.4.7 Care should be taken to ensure that faces of shaft ends do not project out of the half coupling faces, when the latter are fitted on to the pump and prime mover shaft extensions. Otherwise they may rub against each other and/or will not allow sufficient clearance for unhampered endwise movement of the shafts.

3.4.8 Even if the pump and its prime mover of a coupled set are properly aligned to each other at the manufacturer's works, the alignment gets invariably disturbed while handling during the transit of the set to the installation site. It is, therefore, always necessary to check up this alignment and make necessary adjustments for proper realignment, before the pumpset is placed on the foundation according to 3.2.4. This realignment should be rechecked once again after grouting has set on the foundation.

3.5 *Piping*

3.5.1 The suction and discharge piping should be connected only after ensuring that the grout is sufficiently set.

3.5.2 In order to have least possible friction head losses it is recommended to employ suction pipe as direct and short as possible. If a long suction line is unavoidable, the pipe size should be suitably increased to reduce friction head losses. It is preferred that the pump suction line is made of an eccentric reducer and large size suction pipes. For reduced friction and more uniform flow large radius elbows should be preferred.

3.5.3 The discharge line should be provided with a check valve after the pump and a gate valve should be placed next to the check valve. The gate valve is used when the pump is to be primed or shut down for inspection and repairs.

3.5.4 Piping should be such that it does not impose excessive forces and moments on the pump casing to which it is connected, since it might spring the pump or pull it out of position. Piping flanges should be brought squarely together before the bolts are tightened. The suction and discharged piping and all valves, strainer, etc, should be supported and anchored near to but independent of the pump, so that no strain will be transmitted to the pump casing.

3.6 *Final Installation* — After the piping is over, alignment should be thoroughly checked and corrective action taken, if necessary. Now the nuts are finally tightened.

3.7 The rotating parts such as couplings, fly wheel pulley, belts, etc, should be properly protected by guards.

EXPLANATORY NOTE

Agricultural land is now irrigated according to the requirements with the help of pumps. To accomplish this, the following two points are considered:

1) Selection of a suitable type of pump to suit the requirements, and
2) Proper installation, operation and maintenance of the selected pump to ensure smooth functioning and prolonged life.

One of the important factors influencing successful operation and maintenance of pumps for agricultural purposes is its correct installation. Properly installed pumps remain in suitable alignment for longer periods, and vibrate less. An important gain which can be derived out of correct installation is the longer operating life of the pump with smooth functioning.

This part of the code has been prepared with an intention to provide sufficient guidelines to the farmers to enable them to take satisfactory services from the pumps by installing them correctly.

This standard is being issued in the following four parts for easy reference:

Part I Selection

Part II Installation

Part III Operation

Part IV Maintenance

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AMENDMENT NO. 1 JANUARY 1991

TO

IS 9694 (Part 2) : 1980 CODE OF PRACTICE FOR THE SELECTION, INSTALLATION, OPERATION AND MAINTENANCE OF HORIZONTAL CENTRIFUGAL PUMPS FOR AGRICULTURAL APPLICATIONS

PART 2 INSTALLATION

(*Page* 1, *clause* 2.1) — Insert the following at the end:

'Grease cups, if any, companion flanges with nuts and bolts.'

(*Page* 2, *clause* 3.1.1) — Insert the following new paragraph at the end:

'If the pumping water level in the pit or open well or dug-cum-bored well is more than six metres, the pump may be installed in the well on a special platform created for such pump so as to keep the suction lift at minimum possible level. If the seasonal variations in pumping water levels are excessive, that is, more than 6·0 m, 2 or more platforms have to be created in the well so as to place the pump very near to the pumping water level in operating season.'

(*Page* 4, *clause* 3.5.2, *third sentence*) — Substitute the following for the existing sentence:

'It is preferred that pump suction line is joined with pump flange by an eccentric reducer, if needed.'

(HMD 20)

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