IS : 10037 (Part 3) - 1983

(Reaffirmed 1996)

Indian Standard

REQUIREMENTS FOR SLUDGE DEWATERING EQUIPMENT

PART 3 CENTRIFUGAL EQUIPMENT (SOLID BOWL TYPE)

UDC 628·336·43

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2

August 1983

Indian Standard

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(*Continued on page* 8)

Indian Standard

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PART 3 CENTRIFUGAL EQUIPMENT (SOLID BOWL TYPE)

0. FOREWORD

0.1 This Indian Standard (Part 3) was adopted by the Indian Standards Institution on 22 June 1983, after the draft finalized by the Public Health Engineering Equipment Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The process of high speed centrifuging has been found useful to reduce the moisture in sludge to around 60 percent. Centrifuges can normally accept feed slurries up to 20 percent. Most industrial sludges respond to centrifugal dewatering. The performance of the centrifuge varies according to the type and condition of the sludge. However, it is generally possible to handle the cake having a "crumb like" texture, suitable for trucking to landfill or direct feed to incenerator.

0.3 Use of polyelectrolytes as conditioning agents has widened the scope of employing centrifuges for dewatering all types of waste sludges. In the case of sludges having a fair amount of fibrous or mineral material the centrifuges give acceptable recovery without addition of any flocculating agent.

0.4 Line diagram of centrifugation system is given in Fig. 1.

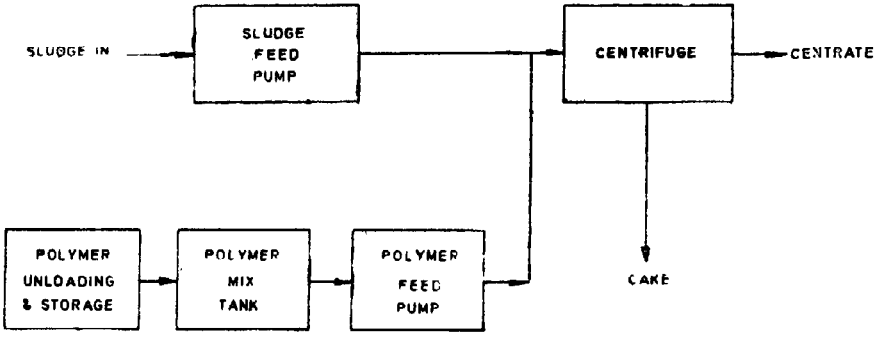

FIG. 1 CENTRIFUGATION SYSTEM

0.5 This standard is being published in three parts. Part 1 relates to sludge drying beds—sand, gravel and underdrains and Part 2 relates to vacuum filtration equipment.

0.6 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 3) lays down the requirements for horizontal solid bowl scroll discharge centrifuge, commonly known as decanters for sludge dewatering.

2. MATERIAL OF CONSTRUCTION

2.1 All the parts of decanter which come in contact with sludge intended for sludge dewatering shall be made of stainless steel conforming to IS : 6911-1972†.

2.2 The bowl shell and conveyor hub shall be fabricated from centrifugal stainless steel casting.

3. PROCESS CONSIDERATIONS

3.1 Major process considerations for centrifugation are feed rate, sludge solids characteristics, feed consistency temperature and chemical additives.

4. CRITERIA FOR SELECTION

4.1 Centrifuges should preferably be selected on the basis of pilot tests with smaller geometrically similar machine. Proper scale up for predictable results should consider and provide for the following:

a) Physical nature of solids being handled,

b) Stability of centrifuge feed,

*Rules for rounding off numerical values (*revised*).

†Specification for stainless steel plate sheet and strip.

c) Solid dewatering time,

d) Chemical flocculent dosages,

e) Present solid recovery,

f) Resistance to abrasion, and

g) Wet cake discharge rate.

5. OPERATION

5.1 The centrifuges have a solid bowl rotating at speeds to generate centrifugal force of about 2 000 times the gravity force and above. The sludge to be dewatered is introduced into the revolving bowl through a stationary feed tube at the centre of rotation. It is then acted upon by the centrifugal separation force ranging to well beyond 2 000 times the force of gravity. The solids are thrown against the wall of the bowl. The liquid, being of lesser density, forms a concentric inner layer in the bowl. Solids are continuously removed by screw conveyor action. The helical screw conveyor, located inside the revolving bowl, rotates in the same direction but at slightly lower speed than that of the bowl. Solids, deposited against the wall of the bowl, are moved by the conveyor to one end of the bowl where they are "plowed" up the beach and out of the liquid layer. The solids are then discharged from the bowl through suitably located ports into covers which lead them to the desired container. The liquid that separates out is continuously removed as it overflows adjustable weirs at the liquid discharge end of the bowl. Again, a suitable discharge cover leads the liquids away and keeps it separated from the solids.

5.2 Typical sketch of centrifuges is shown in Fig. 2.

6. MAINTENANCE

6.1 The centrifuge shall be opened up once a year or so for inspection and service.

7. DESIGN CONSIDERATIONS

7.1 There are a number of variables that affect the performance of the centrifuge and these variables can be broadly classified as under:

a) Mechanical variables, and

b) Operational variables.

7.1.1 The following mechanical parameters affect the performances of the centrifuge:

a) Bowl diameter,

b) Bowl length,

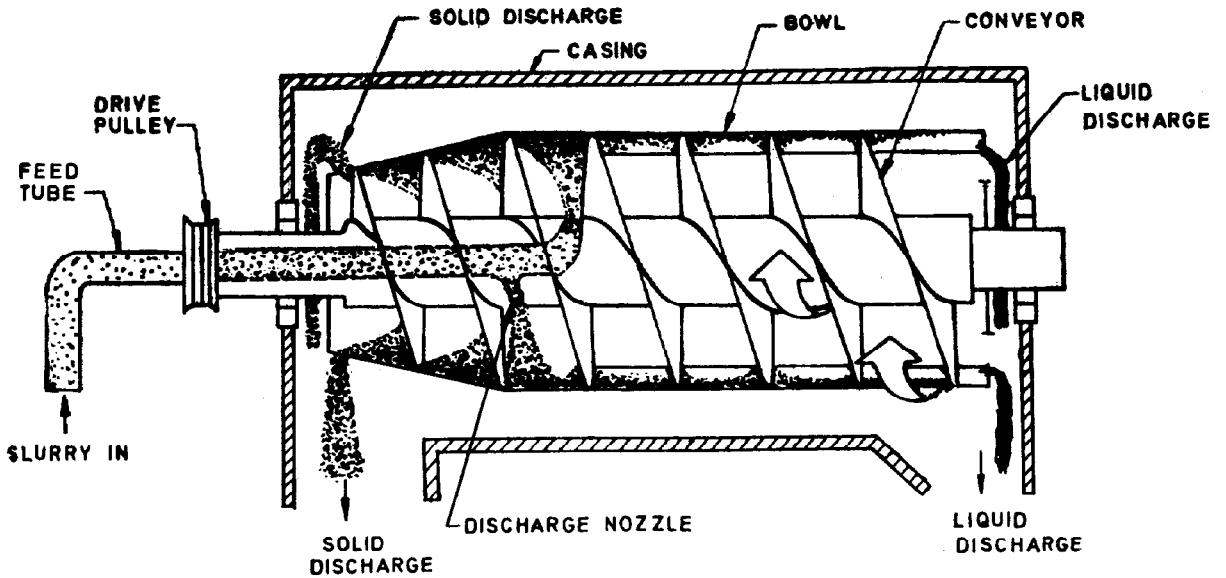

FIG. 2 TYPICAL DETAILS OF CENTRIFUGE

c) Bowl rotating speed,

d) Beach angle,

e) Beach length,

f) Pond depth,

g) Scroll differential speed,

h) Scroll design, and

j) Feed point of sludge.

7.1.2 The following operational variables affect the performance of a centrifuge:

a) Pond depth and feed rate, and

b) Sludge characteristics.

7.2 By carefully selecting and optimising the above parameters, the sludge can be dewatered by centrifuge to give optimum results, for example, maximum solid capture, minimum cake moisture and maximum clarity of liquid.

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