

IS : 2720 (Part XXX) - 1980

(Reaffirmed 2002)

Edition 2.1

(1984-05)

Indian Standard

METHODS OF TEST FOR SOILS

PART XXX LABORATORY VANE SHEAR TEST

(First Revision)

(Incorporating Amendment No. 1)

UDC 624.131.377

© BIS 2003

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

Price Group 2

Indian Standard

METHODS OF TEST FOR SOILS

PART XXX LABORATORY VANE SHEAR TEST

(*First Revision*)

Soil Engineering and Rock Mechanics Sectional Committee, BDC 23

Chairman

Representing

DR JAGDISH NARAIN

University of Roorkee, Roorkee

Members

ADDITIONAL DIRECTOR, IRI

Irrigation Department, Government of Bihar,
Patna

ADDITIONAL DIRECTOR RESEARCH
(F. E.), RDSO

Ministry of Railways

DEPUTY DIRECTOR RESEARCH (SOIL
MECH), RDSO (*Alternate*)

PROF ALAM SINGH

University of Jodhpur, Jodhpur

COL AVTAR SINGH

Engineer-in-Chief's Branch, Army
Headquarters

LT-COL V. K. KANITKAR (*Alternate*)

DR A. BANERJEE

Cemindia Co Ltd, Bombay

SHRI S. GUPTA (*Alternate*)

DR R. K. BHANDARI

Central Building Research Institute, Roorkee

CHIEF ENGINEER (B&R)

Irrigation Department, Government of
Punjab, Chandigarh

DR G. S. DHILLON (*Alternate*)

SHRI M. G. DANDAVATE

The Concrete Association of India, Bombay

SHRI N. C. DUGGUL (*Alternate*)

SHRI A. G. DASTIDAR

In personal capacity (*5 Hungerford Court,
12/1 Hungerford Street, Calcutta 700017*)

DR G. S. DHILLON

Indian Geotechnical Society, New Delhi

DIRECTOR, IRI

Irrigation Department, Government of Uttar
Pradesh, Roorkee

(*Continued on page 2*)

© BIS 2003

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* (XIV of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

IS : 2720 (Part XXX) - 1980

(Continued from page 1)

<i>Members</i>	<i>Representing</i>
SHRI A. H. DIVANJI SHRI A. N. JANGLE (<i>Alternate</i>)	Asia Foundations & Construction (P) Ltd, Bombay
PROF GOPAL RANJAN	University of Roorkee, Roorkee
PROF GOPAL RANJAN	Institution of Engineers (India), Calcutta
DR SHASHI K. GULHATI DR G. B. RAO (<i>Alternate</i>)	Indian Institute of Technology, New Delhi
SHRI O. P. MALHOTRA	Public Works Department, Chandigarh Administration, Chandigarh
SHRI T. K. NATRAJAN	Central Road Research Institute, New Delhi
PRESIDENT (IMDA)	All India Instrument Manufacturers & Dealers Association, Bombay
DEPUTY SECRETARY (AIIMDA) (<i>Alternate</i>)	
SHRI R. V. RANTHIDEVAN DEPUTY DIRECTOR (CSMRS) (<i>Alternate</i>)	Central Water Commission, New Delhi
RESEARCH OFFICER (B&RRL)	Public Works Department, Government of Punjab, Chandigarh
SHRI K. R. SAXENA	Public Works Department, Government of Andhra Pradesh, Hyderabad
SECRETARY DEPUTY SECRETARY (<i>Alternate</i>)	Central Board of Irrigation & Power, New Delhi
SHRI N. SIVAGURU SHRI D. V. SIKKA (<i>Alternate</i>)	Roads Wing, Ministry of Shipping & Transport
SHRI K. S. SRINIVASAN SHRI SUNIL BERRY (<i>Alternate</i>)	National Buildings Organization, New Delhi
SUPERINTENDING ENGINEER (P&D)	Public Works Department, Government of Tamil Nadu, Madras
EXECUTIVE ENGINEER (SMRD) (<i>Alternate</i>)	
SHRI H. C. VERMA SHRI H. K. GUHA (<i>Alternate</i>)	All India Instrument Manufacturers & Dealers Association, Bombay
SHRI S. D. VIDYARTHI DR B. L. DHAWAN (<i>Alternate</i>)	Public Works Department, Government of Uttar Pradesh, Lucknow
SHRI G. RAMAN, Director (Civ Engg)	Director General, ISI (<i>Ex-officio Member</i>)

Secretary
SHRI K. M. MATHUR
Deputy Director (Civ Engg), ISI

(Continued on page 8)

Indian Standard

METHODS OF TEST FOR SOILS

PART XXX LABORATORY VANE SHEAR TEST

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part XXX) (First Revision) was adopted by the Indian Standards Institution on 31 October 1980, after the draft finalized by the Soil and Rock Mechanics Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 The laboratory vane shear test for the measurement of shear strength of cohesive soils is useful for soils of low shear strength of less than about 0.5 kgf/cm^2 . This test gives the undrained strength of the soil and the undisturbed and remoulded strengths obtained are used for evaluating the sensitivity of the soil. This standard was first published in the year 1968. This revision has been prepared to incorporate revised shape of vane found useful for this test.

0.3 This edition 2.1 incorporates Amendment No. 1 (May 1984). Side bar indicates modification of the text as the result of incorporation of the amendment.

0.4 In reporting the result of a test of analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960*.

1. SCOPE

1.1 This standard (Part XXX) covers the procedure of conducting laboratory vane shear test on cohesive soils of low shear strength for determining their undrained shear strength.

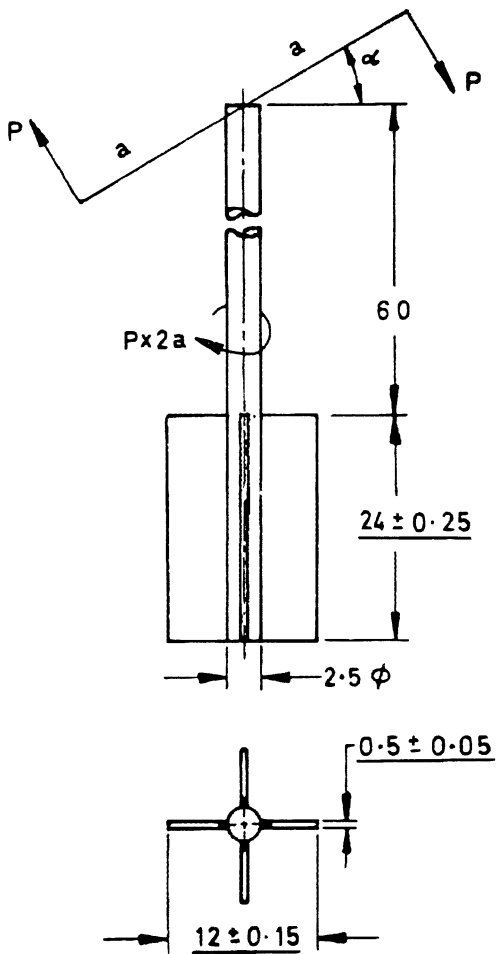
2. APPARATUS

2.1 Vane — The vane shall consist of four blades each fixed at 90° to the adjacent blades as illustrated in Fig. 1. The vane should not deform under the maximum torque for which it is designed. The penetrating edge of the vane blades shall be sharpened having an included angle of 90° . The vane blades shall be welded together suitably to a central rod, the maximum diameter of which should

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

IS : 2720 (Part XXX) - 1980

preferably not exceed 2.5 mm in the portion of the rod which goes into the specimen during the test. The vane should be properly treated to prevent rusting and corrosion.



All dimensions in millimetres.

Essential dimensions underlined.

FIG. 1 PRINCIPLE OF VANE SHEAR TEST

2.2 The apparatus may be either of the hand-operated type or motorized. Provisions should be made in the apparatus for the following:

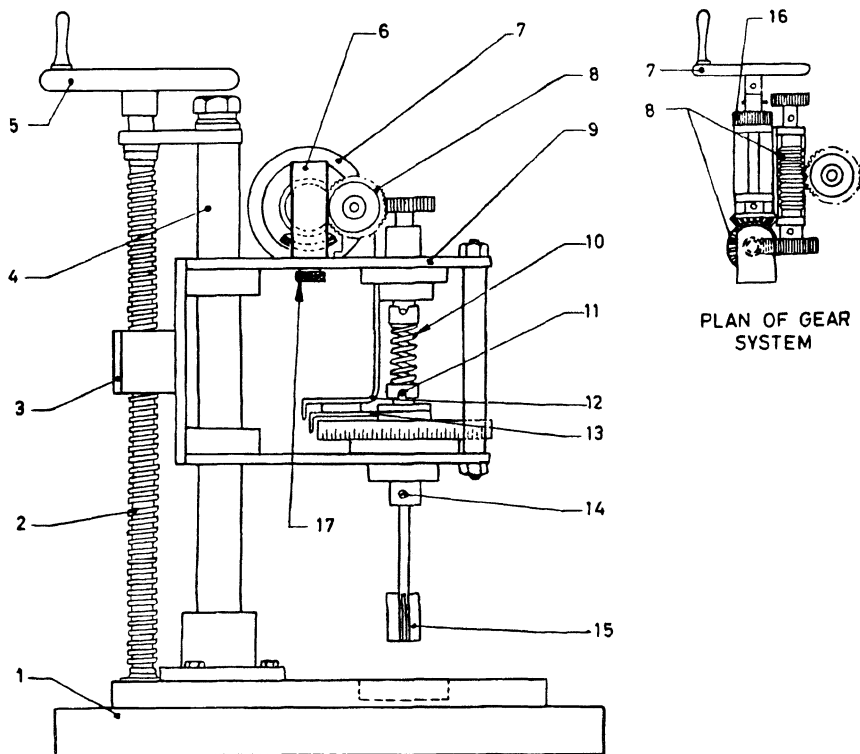
- a) Fixing of vane and shaft to the apparatus in such a way that the vane can be lowered gradually and vertically into the soil specimen.
- b) Fixing the tube containing the soil specimen to the base of the equipment for which it should have suitable hole.
- c) Arrangement for lowering the vane into the soil specimen (contained in the tube fixed to the base) gradually and vertically and for holding the vane properly and securely in the lowered position.
- d) Arrangement for rotating the vane steadily at a rate of approximately 1/60 rev/min (0.1°/s) and for measuring the rotation of the vane.
- e) A torque applicator to rotate the vane in the soil and a device for measuring the torque applied to an accuracy of 0.05 cm.kgf.
- f) A set of springs capable of measuring shear strength of 0.5 kgf/cm².

2.2.1 A typical form of the hand operated apparatus is shown in Fig 2.

3. PROCEDURE

3.1 The specimen in the tube should be at least 30 mm in diameter and 75 mm long. Mount the specimen container with the specimen on the base of the vane shear apparatus and fix it securely to the base. If the specimen container is closed at one end it should be provided at the bottom with a hole of about 1 mm diameter. Lower the shear vanes into the specimen to their full length gradually with minimum disturbance of the soil specimen so that the top of the vane is at least 10 mm below the top of the specimen. Note the readings of the strain and torque indicators. Rotate the vane at a uniform rate approximately 0.1°/s by suitably operating the torque applicator handle until the specimen fails. Note the final reading of the torque indicator. Torque readings and the corresponding strain readings may also be noted at desired intervals of time as the test proceeds.

3.2 Just after the determination of the maximum torque rotate the vane rapidly through a minimum of ten revolutions. The remoulded strength should then be determined within 1 minute after completion of the revolution.



This is only a typical example and any design of apparatus satisfying the requirements specified in 2 may be used.

- | | |
|----------------------------------|------------------------------|
| 1 Base | 10 Torque spring |
| 2 Lead screw | 11 Locating pins |
| 3 Nut | 12 Strain indicating pointer |
| 4 Support pillar | 13 Maximum pointer |
| 5 Lead screw handle | 14 Vane fixing screw |
| 6 Gear bracket | 15 Shear vanes |
| 7 Torque applicator handle | 16 Normal speed gear |
| 8 Slow motion bevel & work gears | 17 Gear bracket clamp screws |
| 9 Bracket | |

FIG. 2 LABORATORY VANE SHEAR APPARATUS

4. COMPUTATIONS

4.1 For vane testing instruments that do not read the torque directly, a calibration curve to convert the readings to cm.kgf of torque shall be provided. These calibration curves shall be checked periodically.

4.2 Calculate the shear strength of the soil using the following formula:

$$S = \frac{3}{19} T$$

where

S = shear strength in kgf/cm², and

T = torque in cm.kgf.

NOTE 1 — This formula is based on the following assumptions:

- a) Shearing strengths in the horizontal and vertical directions are the same;
- b) At the peak value, shear strength is equally mobilized at the end surface as well as at the centre; and
- c) The shear surface is cylindrical and has a diameter equal to the diameter of the vane.

NOTE 2 — It is important that the dimensions of the vane are checked periodically to ensure that the vane is not distorted or worn.

IS : 2720 (Part XXX) - 1980

(Continued from page 2)

Soil Testing Procedures and Equipment Subcommittee, BDC 23 : 3

<i>Convener</i>	<i>Representing</i>
PROF ALAM SINGH	University of Jodhpur, Jodhpur
<i>Members</i>	
SHRI AMAR SINGH DEPUTY DIRECTOR RESEARCH (FE-II), RDSO DEPUTY DIRECTOR RESEARCH (SM-III), RDSO (<i>Alternate</i>)	Central Building Research Institute, Roorkee Ministry of Railways
DIRECTOR (CSMRS) DEPUTY DIRECTOR (CSMRS) (<i>Alternate</i>)	Central Water Commission, New Delhi
PROF GOPAL RANJAN DR S. C. HANDA (<i>Alternate</i>)	University of Roorkee, Roorkee
DR SHASHI K. GULHATI SHRI H. K. GUHA SHRI H. N. BHATTACHARAYA (<i>Alternate</i>)	Indian Institute of Technology, New Delhi Geologists Syndicate Pvt Ltd, Calcutta
SHRI O. P. MALHOTRA	Public Works Department, Chandigarh Administration
SHRI M. D. NAIR PROF T. S. NAGARAJ (<i>Alternate</i>)	Associated Instruments Manufacturers (I) Pvt Ltd, New Delhi
SHRI N. M. PATEL SHRI P. JAGANATHA RAO COL AVTAR SINGH LT-COL V. K. KANITKAR (<i>Alternate</i>)	Delhi College of Engineering, Delhi Central Road Research Institute, New Delhi Engineer-in-Chief's Branch, Army Headquarters
SHRI S. D. VIDYARTHI DR B. L. DHAWAN (<i>Alternate</i>)	Public Works Department, Government of Uttar Pradesh, Lucknow

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed by Technical Committee : BDC 23.

Amendments Issued Since Publication

Amend No.	Date of Issue
Amd. No. 1	May 1984

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002.
Telephones: 323 01 31, 323 33 75, 323 94 02

Telegrams: Manaksanstha
(Common to all offices)

Regional Offices:

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110002	{ 323 76 17 323 38 41
Eastern : 1/14 C. I. T. Scheme VII M, V. I. P. Road, Kankurgachi KOLKATA 700054	{ 337 84 99, 337 85 61 337 86 26, 337 91 20
Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160022	{ 60 38 43 60 20 25
Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600113	{ 235 02 16, 235 04 42 235 15 19, 235 23 15
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) MUMBAI 400093	{ 832 92 95, 832 78 58 832 78 91, 832 78 92

Branches : AHMEDABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE.
FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR. LUCKNOW.
NAGPUR. NALAGARH. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.
VISHAKHAPATNAM