

IS : 2720 ( Part XXX ) - 1980

*Indian Standard*

METHODS OF TEST FOR SOILS

PART XXX LABORATORY VANE SHEAR TEST

( *First Revision* )

UDC 624.131.377



© Copyright 1980

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

Price Rs 5.00

Gr 2

December 1980

*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*

DR JAGDISH NARAIN

*Representing*

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 ( <i>Alternate</i> )	
PROF ALAM SINGH	University of Jodhpur, Jodhpur
COL AVTAR SINGH	Engineer-in-Chief's Branch, Army Headquarters
LT-COL V. K. KANITKAR ( <i>Alternate</i> )	
DR A. BANERJEE	Cemindia Co Ltd, Bombay
SHRI S. GUPTA ( <i>Alternate</i> )	
DR R. K. BHANDARI	Central Building Research Institute, Roorkee
CHIEF ENGINEER ( B&R )	Irrigation Department, Government of Punjab, Chandigarh
DR G. S. Dhillon ( <i>Alternate</i> )	
SHRI M. G. DANDAVATE	The Concrete Association of India, Bombay
SHRI N. C. DUGGUL ( <i>Alternate</i> )	
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 )*

© Copyright 1980

INDIAN STANDARDS INSTITUTION

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.

( Continued from page 1 )

<i>Members</i>	<i>Representing</i>
SHRI A. H. DIVANJI	Asia Foundations & Construction ( P ) Ltd, Bombay
SHRI A. N. JANGLE ( <i>Alternate</i> )	
PROF GOPAL RANJAN	University of Roorkee, Roorkee
PROF GOPAL RANJAN	Institution of Engineers ( India ), Calcutta
DR SHASHI K. GULHATI	Indian Institute of Technology, New Delhi
DR G. B. RAO ( <i>Alternate</i> )	
SHRI O. P. MALHOTRA	Public Works Department, Chandigarh Adminis- tration, 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	Central Water Commission, New Delhi
DEPUTY DIRECTOR ( CSMRS ) ( <i>Alternate</i> )	
RESEARCH OFFICER ( B&RRL )	Public Works Department, Government of Punjab, Chandigarh
SHRI K. R. SAXENA	Public Works Department, Government of Andhra Pradesh, Hyderabad
SECRETARY	Central Board of Irrigation & Power, New Delhi
DEPUTY SECRETARY ( <i>Alternate</i> )	
SHRI N. SIVAGURU	Roads Wing, Ministry of Shipping & Transport
SHRI D. V. SIKKA ( <i>Alternate</i> )	
SHRI K. S. SRINIVASAN	National Buildings Organization, New Delhi
SHRI SUNIL BERRY ( <i>Alternate</i> )	
SUPERINTENDING ENGINEER ( P&D )	Public Works Department, Government of Tamil Nadu, Madras
EXECUTIVE ENGINEER ( SMRD ) ( <i>Alternate</i> )	
SHRI H. C. VERMA	All India Instrument Manufacturers & Dealers Association, Bombay
SHRI H. K. GUHA ( <i>Alternate</i> )	
SHRI S. D. VIDYARTHI	Public Works Department, Government of Uttar Pradesh, Lucknow
DR B. L. DHAWAN ( <i>Alternate</i> )	
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<sup>2</sup>. 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** 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.

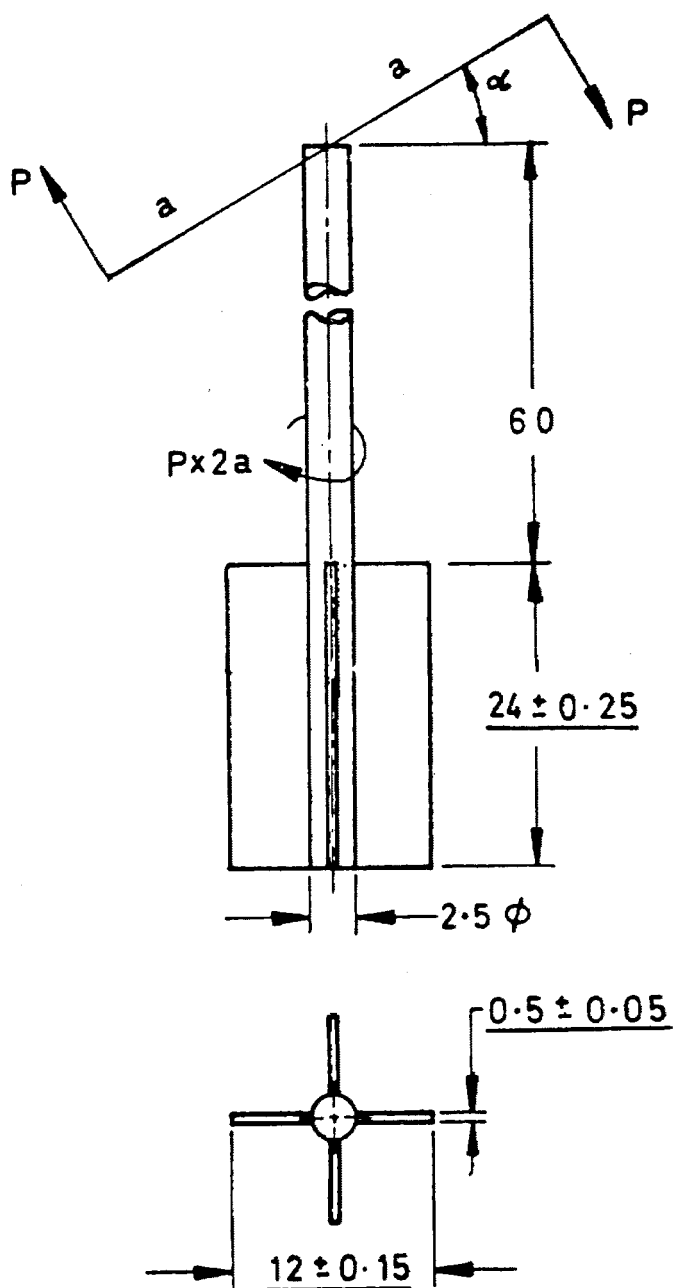
**2. APPARATUS**

**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

---

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

edge of the vane blades shall be sharpened having an included angle of  $90^\circ$ . The vane blades shall be welded together suitably to a central rod, the maximum diameter of which should 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:

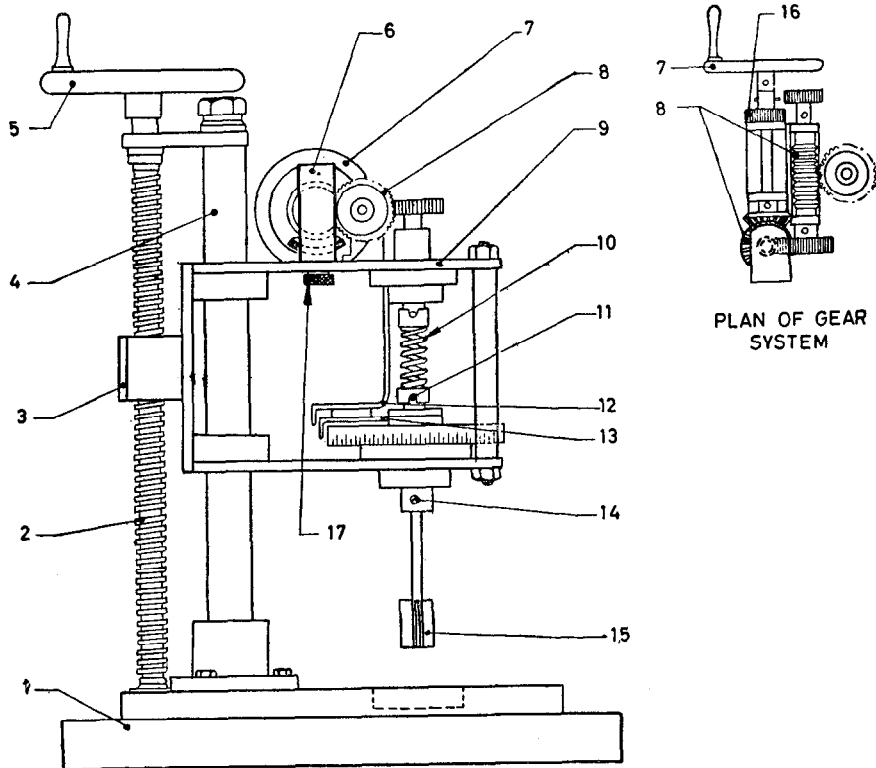
- a) Fixing of vane and shaft to the apparatus in such a way that the vane can be lowered gradually and vertically into the soil specimen.
- b) Fixing the tube containing the soil specimen to the base of the equipment for which it should have suitable hole.
- c) Arrangement for lowering the vane into 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 (  $0.1^\circ/\text{s}$  ) 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/cm<sup>2</sup>.

**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 37.5 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  $0.1^\circ/\text{s}$  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/cm<sup>2</sup>, 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.



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

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

## INDIAN STANDARDS INSTITUTION

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 26 60 21, 27 01 21

Telegrams : Manaksanstha

### Regional Offices:

		Telephone
Western : Novelty Chambers, Grant Road	BOMBAY 400007	37 97 29
Eastern : 5 Chowringhee Approach	CALCUTTA 700072	27 50 90
Southern : C. I. T. Campus, Adyar	MADRAS 600020	41 24 42

### Branch Offices:

'Pushpak', Nurmohamed Shalkh Marg, Khanpur	AHMADABAD 380001	2 03 91
'F' Block, Unity Bldg, Narasimharaja Square	BANGALORE 560002	2 76 49
Gangotri Complex, Bhadbhada Road, T. T. Nagar	BHOPAL 462003	6 27 16
22E Kalpana Area	BHUBANESHWAR 751014	5 36 27
Ahimsa Bldg, SCO 82-83, Sector 17C	CHANDIGARH 160017	2 83 20
5-8-56C L. N. Gupta Marg	HYDERABAD 500001	22 10 83
D-277 Todarmal Marg, Banipark	JAIPUR 302006	6 98 32
117/418 B Sarvodaya Nagar	KANPUR 208005	8 12 72
Patliputra Industrial Estate	PATNA 800013	6 28 08
Hantex Bldg (2nd Floor), Rly Station Road	TRIVANDRUM 695001	32 27

Printed at New India Printing Press, Khurja, India

AMENDMENT NO. 1    MAY 1984

TO

IS:2720(Part 30)-1980    METHODS OF TEST FOR SOILS

PART 30    LABORATORY VANE SHEAR TEST

*(First Revision)*

Alteration

*(Page 5, clause 3.1, line 1) - Substitute '30 mm'  
'37.5 mm'.*

C 23)

---

Reprography Unit, BIS, New Delhi, India