***IS 5223 : 1993***

***Draft Indian Standard***

**OILSEEDS MILLING MACHINERY - OIL EXPELLERS - TEST CODE**

**(Second Revision)**

**FOREWORD**

***Adoption clause will be added later***

Oilseeds milling is one of the major industries in India. The main machinery employed in the process of milling and extracting of oil from oilseeds consists of animal or power driven ghanies, expellers and solvent extraction plants. The oilseeds and subsequently the expressed oil are held in a scooped circular pit in the exact centre of a circular mortar made of stone or wood. In it works a stout, upright pestle which descends from a top curved or angled piece, in which the pestle rests in a scooped-out hollow that permits the pestle to rotate, eased by some soapy or oily lubricant.Expellers are by far the most common machineryemployed in extracting oil from various oilseeds like groundnut, linseed, mustard, and rapeseed.

This standard was first published in 1969 covering methods of test with regard to oil content of residual cake and power consumption at no load. Since then, improvements have been made in extracting more oil from seed and thrust has been given in conserving the energy. Therefore, a need was felt to revise the standard to provide more elaborate procedure for conducting the test including consumption of power at load and linking the capacity with extraction efficiency. A list of Indian Standards on oilseeds and oils to which the millers and testing authorities may be interested is given in Annexure A for guidance.

In reporting the result of a test or 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 ‘Rules for rounding off numerical values ( revised)’.

**1 SCOPE**

This standard prescribes method for testing of oil expellers.

**2 REFERENCE**

The following Indian Standards are necessary adjuncts to this standard:

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| 3579: 19664421: 19674428: 19677874 (Part 1)1975stuffs: | Methods of test for oil seeds Grading for groundnut kernels for oil milling andtable useGrading for mustard seedsfor oil millingMethod of test for animalfeeds and feeding Part 1 General method |

**3 TERMINOLOGY**

**3.0** For the purpose of this standard, the following definition shall apply.

**3.1 Capacity**

The quantity of the oil seed crushed in kg/h with 8 percent maximum extraction of oil in two stages of crushings and without change of acid value of oil from its original value.

NOTE - The capacity may be declared with respect to groundnut kernels (see IS 4427: 1967).

**3.2 Foreign Matter**

It includes inorganic and organic matter. The inorganic matter shall include sand, gravel, dirt, pebbles, stones, lumps of earth, mud and iron chips. The organic matter shall include chaff, straw, weed seed, dead insects, worms and other grains.

**4 SELECTIONS AND SPECIFICATION OF OIL EXPELLERS**

**4.1 Selection**

For Commercial test report or for certification purpose, the oil expeller shall be selected from the series production by the testing authority. For prototype testing or for confidential test, expeller shall be submitted by the manufacturer.

**4.2 Specification and Other Literature**

The manufacturer shall provide all literature, operational manual and specification sheet as given in Annexure B duly filled in. The manufacturer shall indicate the maximum input capacity, rated capacity and output capacity and furnish any further information which might be required to carry out the tests.

**5 TESTS**

**5.1 General**

a) Checking of specification,

b) Checking of material, and

c) Visual observation and checking of provision for adjustment.

**5.2 Test at No Load**

a) Power consumption, and

b) Visual observation.

**5.3 Test at Load**

a) Determination of the oil content of residual cake,

b) Determination of acid value in oil,

c) Power consumption,

d) Determination of capacity, and

e) Visual observation.

**5.4 Long-Run Test**

**6 PRE-TEST OBSERVATIONS**

**6.1 Determination of the Foreign Matter**

The seed mass shall be physically examined in accordance with 4 of 3579: 1966.

**6.2 Determination of Moisture Content**

The moisture content of the seed mass shall be determined in accordance with 5.1 of IS 3579: 1966, by keeping 2±0.5 g of the sample for one hour at 105±1°C in a hot air oven. For details refer IS 3579: 1966.

**6.3 Determination of Oil Content**

The oil content of the oil seed shall be determined in accordance with 5.2 of IS 3579: 1966, following the Soxhlet extraction method.

**6.4 Determination of Acid Value of the Extracted Oil**

The acid value of the extracted oil shall be determined in accordance with 5.3 of IS 3579 : 1966, by directly titrating the oil in an alcoholic medium with aqueous sodium or potassium hydroxide solution.

**7 RUNNING-IN AND PRELIMINARY ADJUSTMENTS**

**7.1** The oil expeller shall be installed on level and preferably on hard surface. All the adjustments shall be made in accordance with the manufacturer’s recommendations.

**7.2** The expeller shall be attached with a suitable prime mover preferably with an electric motor of capacity recommended by the manufacturer and auto voltage stabilizer. An energy meter or some form of transmission dynamometer shall be fitted. The power delivered to the expeller may be supplied in the following ways:

a) Directly coupling the prime mover with the main shaft of the expeller, and

b) Connecting the prime mover with the help of flat or V-belt and pulleys with the main shaft of the expeller.

NOTE: In case of (a), the power delivered to the expeller would be the power output of the prime mover; whereas in case of (b), the allowances of 6 and 3 percent, respectively may be made for flat and V-belt drives towards transmission loss.

**7.3** The expeller shall be run-in without load before commencing the test. The running in shall be carried out in accordance with the manufacturer’s recommendation. In the absence of any recommendation by the manufacturer, the expeller shall be run-in for 30 minutes under no load / without load. During the period of run-in, adjustment for various functional components may be done. All the adjustments done shall be in accordance with the instructions contained in the instructions manual supplied by the manufacturer.

**8 GENERAL TESTS**

**8.1 Checking of Specification**

The specifications given by the manufacturer shall be checked and reported in the proforma given in Annexure B.

**8.2 Checking of Material**

The material of construction of various components of the machine shall be reported in the data sheet given in Annexure C.

**8.3 Visual Observation and Checking of Provision for Adjustments**

The observations and adjustments given in the data sheet in Annexure D shall be made and reported.

**9 TEST AT NO LOAD**

**9.1 Power Consumption**

Run the expeller at no load for at least half-an hour at the specified revolution of expelling unit and record the readings of the energy-meter at interval of 5 minutes. The difference between two consecutive readings shall give power consumption for 5 minutes. Calculate power consumption at no load for one hour. Record the data according to item (1) of Annexure E.

**9.2 Visual Observations**

During and after completing power consumption test (see 9.1), the observation given in item (2 1 of Annexure E shall be made visually and recorded.

**10 TEST AT LOAD**

**10.1 Test Material**

The test material shall be a cleaned seed or kernel. Groundnut and mustard shall be preferred;these shall conform to IS 4427 : 1967 and IS 4428 : 1967, respectively. The quantity shall be sufficient to work the expeller for a period of 60 minutes after reading the normal working condition.

**10.2 Condition of Cooking**

The cooking temperature and the duration of cooking the oil seed shall be mentioned in the report.

**10.3 Operation and Collection of Data**

The expeller shall be operated at its specified speed and at maximum operating pressure / operational choke setting after achieving the normal steady state operation (outlet cake temperature has been stabilized ) for 20 minutes at a feed rate slightly below the capacity specified by the manufacturer. During the run period collect the following sample and data:

a) 4 sets of the samples of oil cake and oil from the relevant outlet at an interval of

5 minutes; and

b) The speed of the main shaft and the reading of energy meter or dynamometer.

**10.3.1** At the end of the 20 minutes feeding, run the expeller for some time so that practically no more material already fed comes out. The oil cake coming out of the expeller should be fed once again for extraction of remaining oil. At the end of the test collect and weigh the oil and oil cake, respectively. The mass of the sample collected should be added.

**10.3.2** The test given at 10.3.1 shall be repeated for minimum of 2 times at 100 and 110 percent of the capacity declared by the manufacturer.

NOTE - For the purpose of certification, the test at 10.3 and 10.3:1 shall be conductable at the declared capacity of the manufacturer and test at 10.3.2 need not be conducted.

**10.3.2.1** The data shall be recorded in accordance with Annexure F.

**10.4 Analysis of Samples**

**10.4.1** *Determination of the Oil Content of Residual Cake*

The oil content in the residual cake shall be determined in accordance with 7 of IS 7874 (Part 1): 1975, following Soxhlet or other suitable extraction method and the data shall be recorded in Annexure F.

**10.4.2** *Determination of Acid Value in Oil*

The acid value of the extracted oil sample shall be determined in accordance with 5.3 of IS 3579: 1966 by directly titrating the material in an alcoholic medium with aqueous sodium or potassium hydroxide solution. The data shall be recorded in Annexure F.

**10.5 Power Consumption**

The power requirement of each feed rate shall be calculated in accordance with the **10.5.1** and **10.5.2.**

**10.5.1** In case of prime mover fitted with energy meter the readings taken shall be the power consumption for 5 minutes. The power consumption per hour giving due allowance to the type of drive shall be calculated and reported.

**10.5.2** In case of prime mover fitted with the dynamometer, the reading taken shall indicate the torque required. The power consumption per hour giving due allowance to the type of drive (see 7.2) shall be calculated by the following formula:

 P = T x S

 973.363

where

P = power, kW

T = torque, Nm

S = speed, rev/min.

NOTE - For the purpose of certification, the power consumption at the declared feed rate shall only be calculated.

**10.5.3** Record the data in accordance with Annexure F.

**10.6 Rated Input Capacity**

Select the feed rate at which the residual oil in oil cake is not more than 8 percent with no change of acid value of oil from its original value. The capacity in terms of the -energy consumed shall be calculated by dividing the capacity by power consumed and shall be expressed in kg/kWh. Record the data in Annexure F.

NOTE -- For the purpose of certification, since the expeller has been operated only at declared capacity, it shall be seen whether the extraction efficiency is met at the declared capacity or not.

**11 LONG RUN TEST**

The expeller shall be operated for a minimum, period of 20 hours at no load. This period should be covered in a maximum of 4 continuous runs. During and after the operation record the major breakdowns, defects developed and repairing made into the data sheet given in Annex ‘G’.

**ANNEX A**

*(Foreword)*

**LIST OF SOME OF THE INDIAN STANDARDS ON OIL AND OILSEEDS**

|  |  |
| --- | --- |
| IS No. | Title |
| 75 : 1973 | Linseed oil, raw and refined ( second revision ) |
| 435 : 1973 | Caster oil ( second revision ) |
| 542 : 1968 | Coconut oil ( second revision ) |
| 543 : 1968 | Cottonseed oil ( second revision) |
| 544 : 1968 | Groundnut oil (second revision) |
| 545 : 1984 | Mahua oil ( third revision ) |
| 546 : 1975 | Mustard oil ( second revision ) |
| 547 : 1968 | Sesame oil ( second revision ) |
| 3448 : 1984 | Rice bran oil ( second revision ) |
| 3490 : 1965 | Nigerseed oil |
| 3491 : 1965 | Safflower oil |
| 3492 : 1965 | Karanja oil |
| 4055 : 1966 | Maize ( corn ) oil |
| 4088 : 1966 | Kusum oil |
| 4115 : 1967 | Methods for sampling of oilseeds |
| 4276 : 1977 | Soybean oil (first revision ) |
| 4277 : 1975 | Sunflower oil (first revision ) |
| 4429 : 1967 | Grading for Sesame seed for oil milling |
| 4617 : 1968 | Grading for linseed for oil milling |
| 4618 : 1968 | Grading for castor seeds for oil milling |
| 4619 : 1968 | Grading for Mahua kernels for oil milling |
| 4620 : 1968 | Grading for cottonseed for oil milling |
| 4765 : 1975 | Neem kernel oil and depulped NEEM seed oil (first revision ) |
| 5293 : 1969 | Grading for niger seeds for oil milling |
| 5294 : 1969 | Grading for Kusum seeds for oil milling |
| 5686 : 1970 | Code of practice for handling and storage of oil seeds |
| 6220 : 1971 | Grading of copra for table use and for oil milling |
| 7787 : 1975 | Grading for Neem kernels and depulped Neem seed for oil milling |
| 7797 : 1975 | Grading for soyabeans for oil milling |
| 7798 : 1975 | Grading for sunflower seeds for oil milling |
| 8557 : 1977 | Grading for Kusum kernels for oil milling |
| 11068 : 1984 | Criteria for edibility of oils and fats |
| 11069 : 1984 | Refined, bleached, hydrogenated, winterized and deodorized ( RBHWD ) Soybean oil |

**ANNEX B**

*(Clauses 4.2 and 8.1)*

**SPECIFICATION SHEET**

**1 GENERAL**

To be filled in by Manufacturer/Testing Station

a) Make

b) Model

c) Serial number

d) Year of manufacture

e) Recommended oil seeds for milling

f) Rated capacity, kg/h

g) Address of manufacturer

**2 POWER UNIT**

a) Type of prime mover

b) Recommended power, kW

c) Type of drive

**3 OVERALL DIMENSIONS**

a) Length, mm

b) Width, mm

c) Height, mm

d) Total mass, kg

**4 CHAMBER**

a) Length, mm

b) Bore of chamber, mm

i) without cage bar

ii) with cage bar

c) Number of chambers

d) Number of chamber plates

f) Thickness of chamber plates, mm

g) Chamber bars

i) Number

ii) Size

**5 CAGE BARS**

**a) Plain**

i) Number

ii) Size ( length X height X thickness ),

 mm

**b) Side**

i) Number

ii) Size ( length X height X thickness ),

 mm

**c) Taper**

i) Number

ii) Size ( length X height X thickness ),

 mm

**d) Centre**

i) Number

ii) Size ( length X height X thickness ),

 mm

**e) Spacing**

i) Number

ii) Size ( length X height X thickness ),

 mm

**6 GEAR SECTION**

**a) Main Gear and Pinion**

i) Number of teeth gear/pinion

ii) Outer diameter gear/pinion, mm

iii) Pitch circle diameter gear/pinion, mm, and

iv) Centre distance, mm.

b) Quill Worm Gear and Pinion

i) Number of teeth gear/pinion

ii) Outer diameter gear/pinion, mm

iii) Pitch circle diameter gear/pinion, mm

iv) Centre distance, mm

**7 WORMS**

a) Diameter, mm

b) Bore, mm

c) Speed, rev/mm

**8 KETTLE**

a) Type

b) Heating area, m2

c) Steam pressure, MPa

d) Consumption of steam, kg/h

e) Cooking duration

f) Provision to vary the cooking duration (Yes/ No.)

**9 TOOLS, ACCESSORIES, OPERATIONAL MANUAL AND SPARE PARTS PROVIDED**

NOTE

1 The items which are not applicable in a particular expeller-should be crossed while fitting.

2 If any other items are provided, their details should be given.

**ANNEXURE C**

(*Clause* 8.2)

**DATA SHEET FOR MATERIAL OF CONSTRUCTION**

|  |  |  |
| --- | --- | --- |
| SL NO. | Component | Material |
| a) | Body |  |
| b) | Cage bar |  |
| c) | Worms |  |
| d) | Collar |  |
| e) | Chamber plate |  |
| f) | Chamber bar |  |
| g) | Frame bars |  |
| h) | Gears |  |
| j) | Pinion |  |
| k) | Others |  |

**ANNEXURE D**

*(Clause 8.3)*

**DATA SHEET FOR VISUAL OBSERVATION AND ADJUSTMENTS**

**1 OBSERVATION**

a) Adequacy of marking of inlet and outlets

b) Adequacy of marking of direction of rotation of main worm

c) Adequacy of protection of bearing against ingress of dust,

d) Adequacy of safety arrangement specially at moving parts

e) Provision for lubrication of moving parts

f) Provision of easy changing of components requiring frequent replacement

g) Tightness of bolts and nuts and other fasteners

h) Other observations

j) Adequacy of belt tightening arrangements

k) Adequacy of steam safety valve (when steam is used)

**2 ADJUSTMENTS**

a) Feed rate

b) Speed of main worm

c) Pressure

**ANNEXURE E**

*(Clauses 9.1 and 9.2)*

**DATA SHEET FOR TEST AT NO LOAD**

**1 POWER CONSUMPTION**

a) Source of power

b) Type of drive

C) Total time of run, min

d) Energy meter readings at interval of 5 minutes

e) Average consumption for one hour

**2 OBSERVATIONS**

a) Presence of any marked vibration during operation

b) Presence of undue knocking or rattling sound

c) Any marked wear or slackness in any components

d) Any marked rise in bearing temperature

e) Other observations

**ANNEXURE F**

(*Clauses* 10.3.2.1, 10.4.1, 10.4.2, 10.5.3, and 10.6)

**DATA SHEET FOR TEST AT LOAD**

**1 SOURCE OF POWER**

**2 POWER RATING**

**3 OILSEEDS USED**

a) Type of seed

b) Variety

c) Foreign matter, percent

d) Moisture content, percent

e) Oil content of seed, percent

f) Acid value of oil

**4 ANY OTHER PRESS TREATMENTS (IF ANY)**

**5 COOKING (IF DONE)**

a) Temperature of cooking, °C

b) Duration of cooking, min

**6 EXPELLER DETAIL**

a) Speed, rpm (m/s)

b) Pressure applied on seeds

c) Operational choke setting



**7 OBSERVATIONS**

a) Presence of any marked vibration during operation

b) Presence of any undue noise in operation

c) Leakage of oil and cake

d) Undue heating up of any components

e) Other observations, if any

**8 ANALYSIS OF SAMPLES**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SL No. | Feed Rate kg/h | Sample Mass g | Oil content in Residual Cake | Acid Value of oil |
| (1) | (2) | (3) | (4) | (5) |
|  |  | i) |  |  |
|  |  | ii) |  |  |
|  |  | iii) |  |  |
|  |  | For different feed rate, use datasheet as given above |  |
|  |  |  |

**9 POWER CONSUMPTION, kW**

**10 RATED CAPACITY**

1. kg/h ( l/day )
2. b) kg/kWh

**ANNEXURE G**

(*Clause* 11)

**DATA SHEET FOR LONG RUN TEST**

**1 TOTAL RUNNING TIME**

**2 CONTINUOUS RUNNING TIME**

**3 ANY MAJOR BREAKDOWN**

**4 ANY REPAIR CONDUCTED**

**5 ANY OTHER OBSERVATION**

**ANNEXURE H**

SUMMARY REPORT

|  |  |
| --- | --- |
| 1. Name of manufacturer and address
 |  |
| 1. Model and serial number
 |  |
| 1. Name of testing agency / station
 |  |
| 1. Brief description of oil expeller
 |  |
| 1. Date(s) of test
 |  |
| 1. Type and variety of oilseed used
 |  |
| 1. Moisture content of the feed material, %
 |  |
| 1. Provisions for adjustment of
	1. Steam supply
	2. Cooking duration
	3. Feed rate
 |  |
| 1. Power requirement, kW

a. Recommended power b. At no load c. At load on rated input capacity  |  |
| 1. Rated input capacity, kg/h
 |  |
| 1. Oil in the residual cake, %
 |  |
| 1. Steam consumption kg/h or kg/ kg of oilseed
 |  |
| 1. General
2. Any marked observation affecting performance
3. Any marked breakdown
4. Any other observations, if any
 |  |
|  |