No. TCP/T&R/Local Sugar/26-1/2026 27th November 2026

TENDER FOR PROCUREMENT OF 200,000 MT (TWO HUNDRED THOUSAND METRIC TONS) SUGAR FROM LOCAL SUGAR MILLS

(TERMS & CONDITIONS)

Trading Corporation of Pakistan (Pvt.) Ltd. (TCP), Karachi, a state owned commercial organization working under the administrative control of Ministry of Commerce, Government of Pakistan, in line with Rule-29 of the Public Procurement Rules, 2026, invites sealed bids for purchase of **200,000 MT (Two Hundred Thousand metric tons) White Refined Sugar in 50 Kg standard export packaging PP Bags on DAP (Delivered At Place) TCP Pipri Godown basis,** from the Local Sugar Mills of Pakistan, subject to the terms and conditions specified hereunder:

2. The supply of White Refined Sugar, as above, shall be in accordance with the requirements/specifications laid down by Pakistan Standards Quality Control Authority (PSQCA), as reproduced hereunder:

"COMMODITY SPECIFICATIONS / REQUIREMENT":

i) Granular Size & Minimum Bid Quantity:

a) Medium to Bold Grain Size with Two Years expiry

b) Minimum Lot Size: 5,000 MT on DAP[1] TCP Pipri Godown Basis.

ii) Requirements for White Refined Cane Sugar (HS Code: 1701.9910) are as under:

Sl. No.	Characteristics	Requirement	Methods of Test, Ref to Annex
i)	Loss on drying, percent by mass, Max	0.10	B
ii)	Polarization, Min	99.7°Z	C
iii)	Reducing sugar, percent by mass, Max	0.04	D
iv)	Colour in ICUMSA units, Max	45	E
v)	Conductivity ash, percent by mass, Max	0.04	F
vi)	Sulphur dioxide, mg/kg, Max	15	G
vii)	Lead, mg/kg, Max	0.5	AOAC 999.10 H (alternative method)
viii)	Chromium, mg/kg, Max	20	I
ix)	Copper, mg/kg, Max	2	AOAC 960.40 or AOAC 999.10
x)	Arsenic mg/kg, Max	1	AOAC 986.15 or ICUMSA, GS2/3-23 (2005)

Note: The relevant testing method of ISO, CAC and of other internationally recognized standard methods might be taken into account for analysis purpose.

iii) **SAMPLING**

"The procedure of sampling and testing of White Refined Sugar given in appendices A, B, C, D, E, F, G, H & I at **ANNEXURE-I** are only for seller's information. However, it is the responsibility of the TCP's nominated Surveyor / Inspection Agency to follow the

[1] Delivered At Place INCOTERM

given procedure while inspecting the offered stocks for compliance with TCPs requirements."

iv) **SHELF LIFE**

The Bidder shall declare in the Bid Form that the **shelf life** of the offered sugar, is not less than Two Years from the date of delivery to TCP and with the Month and Year of manufacturing along with the "Best before" month and year marked on the bags as per the Standard.

v) **PACKING**

a) Sugar shall be packed in **new, clean, sound, food-grade polypropylene woven sacks containing 50 kg net Sugar, conforming to PS 3128-2017 (R) (3rd Revision) – Polypropylene Woven Sacks for Packing and Transportation of Food Items** (PSQCA at **ANNEXURE-II**), with a **food-grade polyethylene inner liner**, and suitable for export. The sacks shall meet the requirements of the Standard for sugar as detailed below:

Characteristic	Requirement	Tolerance	Method
Outside length	950 mm (37 in)	± 15 mm	PS ISO 22198
Outside width	559 mm (22 in)	± 10 mm	PS ISO 22198
Mass per sq. meter	94 g	± 5%	PS ISO 3801
Mass per sack	105 g	± 5%	PS ISO 3801
Density (ends and picks), per dm (inch), min	43 (11) each	–	PS ISO 7211-2
Denier of tape, min	985	± 5%	PS ISO 7211-5
Breaking strength of fabric, 5 × 20 cm strip, min (warp / weft)	80 kg / 80 kg	–	PS ISO 13934-1
Breaking strength of seam, min	30 kg	–	PS ISO 13935-1
Bursting strength of base fabric, min	20 kg/cm²	–	PS ISO 13938-1

b) Further requirements of PS 3128-2017 (R):

i) Tapes of virgin food-grade polypropylene granules (calcium carbonate up to 3.0% maximum permitted for sugar sacks) and not less than 2.5 mm (± 3%) wide;

ii) Fabric evenly woven, free from rips, tears and mis-pick;

iii) Sacks **not made from joint pieces**, and no glue or adhesive used for pasting;

iv) Mouth hemmed or heat/cold cut so that tapes do not fray;

v) Seam stitched with single or double row lock or chain stitch, approximately 8 mm (minimum 5 mm) from the edge, fold-over seam of minimum 20 mm through at least four layers, 16 to 20 stitches per decimeter, with nylon, polyester or polypropylene thread;

vi) Marking in food-grade, non-fading, water-resistant ink, clear and free from major smudging;

vii) **UV stabilization** tested to Appendix A (ASTM G 53, breaking strength after 144 hours not less than 50% of original) and **drop test** to Appendix B (PS

4879; 1800 mm, twice on each flat face; no rupture), both of which are treated as mandatory for this tender.

viii) Sack lots shall be sampled and judged under clause 6 and Table III of PS 3128-2017 (R) (conformity if defective sacks, by visual inspection, ends, picks and dimensions, are not more than 10% of the sample, and no sack tested is lighter than 94% of specified mass). The Bidder shall furnish with each lot the sack manufacturer's test certificate showing conformity to PS 3128-2017 (R), and the Standard Mark where licensed.

vi) **MARKING AND LABELLING:**

Each bag shall legibly and indelibly bear:

(a) name of product;
(b) brand or trade name, if any;
(c) name and address of the manufacturer including country of origin;
(d) net mass;
(e) month and year of manufacture;
(f) batch or code number;
(g) the words "Best before … " (month and year);
(h) lot number; (i) the PSQCA standard mark, if licensed; and
(j) any other marking required by TCP in writing before dispatch or by law.

vii) **SAMPLING, TESTING AND CONFORMITY**

Sampling shall be carried out by TCP's nominated Surveyor / Inspection Agency and shall be tested through PCSIR / PSQCA laboratory as per standard requirements.

3. QUANTITY:

i) Upto 200,000 MT (Two Hundred Thousand Metric Tons) Sugar on DAP TCP Pipri Godown Karachi Basis.

ii) Minimum lot size shall be 5,000 MT (Five Thousand Metric Tons) Sugar DAP TCP Pipri Godown Karachi basis. Any bid less than minimum lot quantity shall not be accepted.

4. METHOD OF PROCUREMENT:

Single Stage – Two Envelope Procedure as per Rule-26(1)(b) of the Public Procurement Rules, 2026.

5. CLARIFICATION / REJECTION OF BIDS, SUBMISSION & OPENING OF BIDS:

I. The bid documents can be downloaded from the website of TCP and PPRA till **10:00 A.M. on December 04 2026**. **Interested Local Sugar Mills** may submit their bids in sealed envelopes (duly marked as "Technical Bid" and "Financial Bid") to be dropped in the Tender Box placed at Reception Counter of TCP at 4th Floor, Block "B", Finance & Trade Centre, Shahrah-e-Faisal, Karachi on **December 04 2026, latest by 10:30 A.M.** Bids received through fax/cable shall not be considered. Whereas, clarifications to the bidding process may be ascertained till December 01, 2026 latest by 05:00 P.M.

II. Technical bids will be opened on **December 04 2026 at 11:00 A.M.** in the TCP's Board Room, in presence of the bidders or their authorized representatives who may wish to be present. Whereas, Financial bids of technically qualified bidders shall be opened after completion of technical evaluation on the same day and in the same manner.

III. **TECHNICAL BID (ENVELOPE-1):**

The bidders are required to submit sealed 1st envelope marked as **"TECHNICAL BID"** containing the following information / documents:

Eligibility / Technical Evaluation Criteria:

a) A bid letter / application containing Name and address of the firm with telephone and fax numbers and e-mail address and Names of Directors/Partners/Proprietor.

b) Proof of Registration with Tax Authorities / NTN

c) An **Affidavit on Judicial paper of PKR 100/- (ANNEXURE-III)** to the effect that either the bidder:

1. had never been blacklisted by TCP or cross-debarred by PPRA at the time of the submission of bid.
2. has not been declared bankrupt or, in the case of company or firm, insolvent or being wound up and its activities or affairs are suspended by a Competent Authority or by the Court of law;
3. is not under any legal proceedings which are sub-judice in any court of law, with TCP
4. is not under any legal proceedings which may result in bankruptcy or any other situation entailing the total or partial loss of the right to administer and dispose of the property;
5. has not been convicted by a final judgment of a Court of Law,
6. is not blacklisted or debarred at the time of the submission of bid by an international financial institution, international organizations, or other multilateral development Bank for the period defined by them; and
7. is not convicted in the case of a company, its owners and beneficial owners, directors or officers of a criminal offence related to-
   (i) its professional conduct; or
   (ii) a prohibited practice in the past and has not, or in the case of a company, its owners and beneficial owners, directors or officers have not, been debarred from a procurement process in Pakistan.

d) An **Affidavit on Judicial paper of PKR 100/-** to the effect that the bidder have fulfilled their previous contractual obligations with TCP in the past **(ANNEXURE-IV).**

e) Original Bid Security, equivalent to 2% of the offered quantities, if not enclosed with the bid, the bid shall be rejected.

f) The Bidder shall submit an **undertaking on company's letter** head confirming that their Offer is unconditional and conforms to all quality parameters indicated in the Clause-2 of this tender document and that the bidder shall meet all conditions and timelines for the delivery (**ANNEXURE-IVA**).

g) **Undertaking from the bidder (on official letter head)** that the stocks offered by the bidder are not pledged with any bank or any other financial institution.

h) **NOC from banks / financial institution (pledged stocks):** If any of the offered sugar stocks is pledged, hypothecated or otherwise charged to any bank or financial institution, the Bidder shall furnish a **No Objection Certificate (NOC) from each such bank / financial institution**, on the bank's letterhead, confirming that the bank has no objection to the sale and delivery of the offered quantity to TCP and will release the stock for delivery against the payment. If no stock is so encumbered, the Bidder shall furnish an affidavit on stamp paper to that effect.

i) Lab report from PCSIR/PSQCA laboratory for the offered stocks tested for not more the 1 month prior to offering.

j) **Affidavit on Judicial paper of PKR 100/-** to the effect that all the papers/documents and the information furnished by the bidder along with the bid and/or during the contract / tender execution must be genuine and true in the terms of their contents and that if established otherwise at any later stage during the processing of bid / execution of tender/contract, the bidder / supplier shall be liable to blacklisting attracted under TCP's Blacklisting Order of 2010 (As amended in 2026) dated August 17, 2026 and encashment/forfeiture of any Security submitted to TCP under existing or any other tender/contract, besides any other action which the TCP may take under the law, including forfeiture or encashment of the Bid Bond and/or performance guarantee, or both, must be submitted along with the bid, on the prescribed proforma given at **ANNEXURE-V** of Tender Terms.

k) **The technical bid shall be evaluated on the basis of documents provided under Clause-5(III)(a) to 5(III)(j).**

In case of bidders who fail under technical evaluation, their envelope(s) containing financial bid shall be returned unopened.

Financial bids of the technically qualified bidders will be opened after completion of the technical evaluation on the same day.

IV. FINANCIAL BID (ENVELOPE-2):

The bidders are required to submit sealed 2nd envelope marked as **"FINANCIAL BID"** whereby:

a) Price shall be quoted in **PKR per MT both on Ex-Mill basis and on Delivered at Place (DAP) TCP Pipri Godown basis**, as per Bid Form (**ANNEXURE-VI**).

b) The quoted price shall be inclusive of all taxes, duties, levies, cess, fees, freight, transit insurance, packing, marking at Pipri Godowns, and every other cost of delivering the sugar in accordance with this document. Prices shall be firm and fixed; no escalation or variation is allowed.

c) Bids shall be bifurcated into Ex-Mill Price and freight etc. costs, separately and in total as well in PKR (A+B=Total)/kg or /MT. In case of non-bifurcation, bids shall not be accepted.

The Financial bids of technically qualified bidders shall be evaluated on lowest cost basis on Ex-Mill basis.

6. BID EVALUATION CRITERIA AND ACCEPTANCE:

i) The Bids shall be evaluated on the lowest cost basis for ex-Mill prices.
ii) Bids shall be bifurcated into Ex-Mill Price and freight etc. costs, separately and in total as well in PKR (A+B=Total)/kg or /MT. In case of non-bifurcation, bids shall not be accepted.
iii) In case of identical offers received from one or more bidders, the awarded quantity shall be bifurcated amongst them.
iv) Letter(s) of Acceptance/award will be issued to the successful bidder(s) by e-mail as well as by courier, against details provided in the bid, within the validity of offer/bid.
v) Supplier shall submit "Declaration of Ultimate Beneficial Owners Information" as at **ANNEXURE-VII** immediately on award of contract.
vi) Supplier would be required to sign "Integrity Pact" immediately on award of contract as per the format at **ANNEXURE-VIII**.
vii) TCP reserves the right to accept or reject any or all bids wholly or partially, without assigning any reason as per decision of the Federal Government.
viii) TCP reserves the right to purchase more or less than the advertised quantity, as per decision of the Federal Government.
ix) TCP also reserves the right to award the remaining quantity to next successful bidder and so on until the desired quantities are met and if they agree to bring the price at par with the successful bidder as per Rule-29 of the PPRA Rules, 2026.
x) Any bid less than minimum lot size shall not be acceptable.
xi) Only firm offers/quantity will be considered and conditional bids shall be rejected.
xii) Non-responsive and Incomplete bids shall be rejected.
xiii) Bidders who have not fulfilled any of their existing or previous contractual obligation with TCP shall not be eligible to participate in the Bids, unless they clear their dues along with penalties or fulfill their contractual obligations in services and commodities with TCP, as the case may be, before tender opening date. Furthermore, the suppliers against whom black-listing process is initiated or they have been black-listed by TCP or any other Government department/autonomous body are not eligible to participate.

7. VALIDITY OF BID(S):

Offers should be valid for **Ten (10) Days** from the date of bid submission.

8. BID SECURITY:

i. Each bid shall be accompanied by Bid Security equal to **2% of the total bid value** (quoted price × offered quantity, excluding Sales Tax), in the form of a **Banker's Cheque** issued by a scheduled bank in Pakistan in favour of "Trading Corporation of Pakistan (Pvt) Limited", or a **Bank Guarantee** issued by a Scheduled Bank in Pakistan as per format attached at (**ANNEXURE-IX**) **Insurance Guarantees, surety bonds, pay orders of non-scheduled institutions and cash are not acceptable.**

ii. Bank Guarantee shall be valid for at least two (02) months from bid submission date.

iii. Bid Security of unsuccessful Bidders shall be returned, or the Bank Guarantee released, promptly after the award is made or the proceedings are concluded, and in any case within seven (7) days thereof. The Bid Security of the successful Bidder shall be returned upon furnishing the Performance Guarantee.

iv. Bid Security shall be forfeited if a Bidder:

(a) withdraws or modifies its bid after opening or during bid validity;
(b) having been awarded a contract (including after agreeing to price-matching), fails to furnish the Performance Guarantee or sign the contract within the stipulated time;
(c) is found to have submitted false or materially inaccurate information or to have engaged in a prohibited practice.

9. DOCUMENTS CONSTITUTING CONTRACT:

The IFB (Invitation for Bids), the Terms & Conditions of Tender, the Letter of Acceptance/Award issued by the Buyer and Integrity Pact along with submission of the valid Performance Guarantee shall be integral part and collectively constitute the Contract between the Buyer and the Seller (**ANNEXURE-X**). The Contract shall be valid till successful and complete delivery of the goods as per the agreed quantities as well as terms and conditions of this tender / contract and settlement of buyer's claims (if any) by the seller.

10. PERFORMANCE GUARANTEE:

i) Successful bidder shall be required to furnish a Performance Guarantee verifiable / encashable at the counters of issuing bank, for due and satisfactory performance of the contract, equal to **Five percent (5%)** of the total value of the contracted goods within **Five (05) working days** from award of contract, in the form of a Bank Guarantee in PKR from a minimum Pakistani "A" rated (PACRA/VIS) Bank in Pakistan to be furnished in the prescribed form **(ANNEXURE-XI)** in favour of Trading Corporation of Pakistan (Pvt.) Limited or in the form of a Banker's Cheque in PKR.

ii) The Performance Guarantee may also be remitted in the TCP's below mentioned bank account as per requirements stipulated at clause-10(i), with the condition that the amount should be deposited and reflected in the bank account within time stipulated above. In this scenario, the bank must remit the payment against receipt of written communication from TCP through email from the ID "cfo@tcp.gov.pk" and the same should be deposited in the TCP's following bank account within three hours of email. Any inward / outward charges on the banking transactions shall be borne by the bidder including local taxes:

A/C TITLE	**:**	**TRADING CORPORATION OF PAKISTAN PVT LTD**
IBAN NUMBER	**:**	**PK87NBPA0274003036103044**
NAME OF BANK	**:**	**NATIONAL BANK OF PAKISTAN**
BRANCH CODE	**:**	**0274**
SWIFT CODE	**:**	**NBPAPKKAXXX**
BRANCH NAME	**:**	**FTC BUILDING BRANCH, FINANCE & TRADE CENTRE, SHAHRAH-E-FAISAL, KARACHI**

iii) Satisfactory performance of the Contract includes delivery of goods strictly according to the contract within the stipulated period of delivery to buyer as designated by TCP and settlement of any/all claims under this contract/tender by both the seller and buyer.

iv) If the successful bidder fails to furnish the required performance guarantee as per sub clause 10(i) or 10(ii) above or the encashability / validity (which must be Six Months from the date of issuance / submission) of the same is not confirmed by the relevant bank, the Bid Security of the successful bidder shall be forfeited without any notice besides, award issued shall also be cancelled.

11. FORFEITURE/RELEASE OF PERFORMANCE GUARANTEE:

i) The Buyer shall forfeit / encash the Performance Guarantee if the Supplier:

a) Fails to supply the goods within the specified period.
b) Commits any breach of contract or fails to fulfill any terms or conditions of the contract.
c) In case of any mis-declaration and / or if any earlier default / breach of contract is not disclosed by the seller.

ii) The Performance Guarantee shall be processed for release to the sellers within 15 days of successful and satisfactory execution of the Contract and its full performance; and settlement of all claims under this contract. No claim shall lie against the Buyer in respect of interest on Performance Guarantee regardless of the time of its release.

iii) The seller shall be required to submit written request on principal seller's or local agent's letterhead along with **"No Claims Certificate"** on the principal seller's letterhead and documentary evidence for payment of claims (if any), for release of Performance Bank Guarantee in respect of the relevant tender/contract.

12. CONSIGNMENT INSPECTION AND CERTIFICATION:

i) TCP shall nominate an independent Surveyor/Inspection Agency which shall inspect the cargo and bags for its compliance with the tender T&C, quality and specifications, both at Mill and TCP Pipri Godowns respectively. The cost of inspection, sampling, testing etc. and PSIA fee shall be borne by TCP.
ii) The Surveyor/Inspection Agency shall be responsible for inspection of cargo at all three stages i.e. pre-loading, under loading at the Mill and during unloading/discharging of cargo at TCP Pipri Godown. Copies of all such Survey / Inspection Reports shall be communicated to buyer immediately after issuing by the Surveyor.
iii) The Seller shall offer to the Buyer's nominated Surveyor/ Inspection Agency, the stocks and also shall ensure Surveyors/ Inspection Agency's accessibility to the stocks for inspection, sampling, testing, etc.
iv) The offered sugar and bags shall be rejected if it does not meet any specification(s) and/or prescribed condition(s) of the tender.
v) Surveyor/ Inspection Agency is required to collect samples at Mill and TCP Pipri Godown; and send these samples at internationally accredited laboratory(ies) in Pakistan for testing of same parameters / specification.

13. DELIVERY SCHEDULE:

i. Suppliers shall be required to deliver the cargo at TCP Pipri Godowns within Sixty (60) days from issuance of award letter.
ii. Quantity shall be determined by weighment at TCP's weighbridge at Pipri Godowns: each vehicle shall be weighed laden on entry and empty after unloading, in the presence of the Seller's representative, the Surveyor / Inspection Agency and TCP's representative, and the net weight of sugar shall be the difference, less the weight of the empty bags. The weighbridge slip shall be the sole basis of the quantity accepted, invoiced and paid. The mill's weighbridge slips are for reference only. Sugar shall be treated as delivered only when unloaded, inspected and accepted as stated in the weighbridge weight slip, signed by TCP's Godown In-charge and the Surveyor / Inspection Agency.



iii. TCP may reject any lot or bags that do not conform to the requirements specified in this tender, damaged or burst bags and short-weight bags. Rejected sugar shall be removed by the Seller at its cost and risk and replaced with conforming sugar, free of charge, within fifteen (15) days of written notice in any case.
iv. If the Seller fails to replace rejected sugar, TCP may cancel the affected quantity, purchase equivalent sugar elsewhere, and recover from the Seller any excess cost, in addition to other remedies.
v. Shortage in count or in weight (as determined by TCP's Pipri weighbridge) shall be made good by the Seller or deducted from the invoice value, at TCP's option.

14. PAYMENT:

Payment shall be made by TCP through banking channels by its bank in favour of the Seller for the delivered quantity / value against presentation of the documents listed below:

1. Commercial invoice in PKR for the quantity delivered as determined by TCP's Pipri weighbridge & Surveyor / Inspection Agency at the contract price.
2. Sales tax invoice in the manner required by law.
3. Packing list showing lot and batch numbers, number of bags, net and gross weight, month and year of manufacture and "Best before" date.
4. Delivery challans / truck waybills (GR / builty) for each consignment.
5. Goods Received in satisfactory condition Note signed by TCP's Godown In-charge and the Surveyor / Inspection Agency at Pipri Godowns, confirming unloading, quantity, weight and acceptance.
6. Pre-dispatch inspection release certificate and delivery inspection certificate of the third-party Surveyor/ Inspection Agency on quantity, quality (conformity to PS:1822/SARS 0007-2021), packing, marking and remaining shelf life.
7. Manufacturer's Certificate of Analysis from a recognized laboratory for each batch.
8. Manufacturer's certificate of batch and date of manufacture, declaring that the sugar is fit for human consumption and conforms to the standards and requirements as identified in these tender documents.
9. Halal Certificate issue by Manufacturer.
10. Weighbridge slips of TCP's Pipri Godowns weighbridge (laden and empty weights) for each vehicle, together with the mill's weighbridge slips for reference.
11. Certificate by the Seller that the sugar is free from all encumbrances, claims, liens, charges and demands, including those of banks and financial institutions, supported by the bank's release or NOC where stock was pledged.
12. Surveyor's Certificate for tare weight of the empty bag.
13. Any other document reasonably required by TCP.

Withholding and other taxes shall be deducted as required by law, and TCP shall issue the corresponding certificates.

No advance payment shall be made.

15. TITLE AND RISK:

Risk of loss/theft or damage remains with the Seller until the sugar has been unloaded at Pipri Godowns and accepted as such by TCP. Title passes to TCP on acceptance.

16. DEFAULT AND TERMINATION:

i) TCP may terminate the Contract, wholly or for the undelivered balance, by seven (7) days' written notice if the Seller:

(a) fails to deliver the contracted quantity within the delivery period plus Ten (10) days;
(b) repeatedly delivers non-conforming sugar;
(c) submits false documents or information;
(d) becomes insolvent or is wound up; or
(e) engages in a prohibited practice.

ii) On termination for the Seller's default, TCP may encash the Performance Guarantee, purchase the undelivered balance elsewhere at the Seller's risk and cost, recover its proved losses to the extent not covered by the Performance Guarantee, and initiate blacklisting proceedings under Public Procurement Rules, 2026.

17. FORCE MAJEURE:

Neither party is liable for delay or failure caused by events beyond its reasonable control which could not have been prevented by reasonable diligence, such as natural disaster, war, or governmental action preventing performance. The affected party shall notify the other in writing within three (3) days, with particulars, and shall use best efforts to resume performance. The delivery period shall be extended by the period of the event. If the event is documented and continues beyond Fifteen (15) days, either party may terminate the undelivered balance by written notice, whereupon the Performance Guarantee shall be returned and no liquidated damages apply.

18. ALTERNATE DISPUTE RESOLUTION AND ARBITRATION:

i) The parties shall first attempt to settle any dispute arising out of or in connection with the Contract and its execution, amicably through mutual consultation between senior representatives on both sides within Seven (07) days of notice of the dispute.

ii) Failing amicable mutual settlement, the dispute shall be referred for arbitration before a sole arbitrator appointed by TCP under the Arbitration Act, 1940. The seat shall be Karachi and the language English. The award of the Arbitrator shall be final and binding.

19. GOVERNING LAW:

The Contract is governed by the laws of Pakistan, and the courts at Karachi have jurisdiction.



ANNEXURE-I

PSQCA SPECIFICATION STANDARD FOR SUGAR

(SEE AT THE END OF THE DOCUMENT FROM PAGE-23 TO PAGE-61)



ANNEXURE-II

PSQCA SPECIFICATION FOR SUGAR BAGS

(SEE PAGE-62 TO PAGE-72)



ANNEXURE-III

ON JUDICIAL PAPER OF PKR.100/-

A F F I D A V I T

I/We_____, having office at _____, Holding Company Registration No. _____ do hereby affirm that the bidder:

1. has never been blacklisted by TCP or cross-debarred by PPRA at the time of the submission of bid.
2. has not been declared bankrupt or, in the case of company or firm, insolvent or being wound up and its activities or affairs are suspended by a Competent Authority or by the Court of law;
3. is not under any legal proceedings with TCP or any other person/entity etc. which may result in bankruptcy or any other situation entailing the total or partial loss of the right to administer and dispose of the property;
4. has not been convicted by a final judgment of a Court of Law,
5. is not blacklisted or debarred at the time of the submission of bid by an international financial institution, international organizations, or other multilateral development Bank or any Governmental agency for the period defined by them; and
6. is not convicted in the case of a company, its owners and beneficial owners, directors or officers of a criminal offence related to-
   (i) its professional conduct; or
   (ii) a prohibited practice in the past and has not, or in the case of a company, its owners and beneficial owners, directors or officers have not, been debarred from a procurement process in Pakistan.

7. That whatever is stated above is true and correct to the best of my/our knowledge and belief.

DEPONENT(S)

Messrs._____

_____

_____

Official Stamp

Solemnly affirmed before me on this _____day, by the deponent(s) named above with whose identity I am satisfied on the basis of his/her/their CNIC/passport.

COMMISSIONER FOR TAKING AFFIDAVITS

ANNEXURE-IV

ON JUDICIAL PAPER OF PKR.100/-

A F F I D A V I T

We, the _____, having office at _____, Holding Company Registration No. _____ do hereby affirm:

1. That we have fulfilled their previous contractual obligations with TCP in the past.

2. That whatever is stated above is true and correct to the best of my/our knowledge and belief.

DEPONENT(S)

Messrs._____

_____

_____

Official Stamp

Solemnly affirmed before me on this _____day, by the deponent(s) named above with whose identity I am satisfied on the basis of his/her/their CNIC/passport.

COMMISSIONER FOR TAKING AFFIDAVITS



ANNEXURE-IVA

ON SUPPLIER'S LETTER HEAD

UNDERTAKING

We, the _____, having office at _____, Holding Company Registration No. _____ do hereby undertake:

1. That our Offer is unconditional and conforms to all quality parameters indicated in the Clause-2 of this tender document and that we shall meet all conditions of the tender and timelines for the delivery(s).

2. That whatever is stated above is true and correct to the best of my/our knowledge and belief.

Messrs._____

_____

_____

Official Stamp



ANNEXURE-V

ON JUDICIAL PAPER OF PKR.100/-

A F F I D A V I T

We, the _____, having office at _____, Holding Company Registration No._____ do hereby affirm:

1. That all the papers/documents and information furnished to the Trading Corporation of Pakistan (Pvt.) Limited, Shahrah-e-Faisal. Karachi (TCP) in Tender No.TCP/T&R/Local Sugar/26-1/2026 dated 27th November 2026, are true and genuine. If, at any time, any information or document is found false or incorrect, I/We shall be liable for blacklisting under TCP's Public Notice No. 1 of 2010 (As amended in 2026) dated August 17, 2026, besides any other action which the TCP may take under the law, including forfeiture or encashment of the Bid Bond and/or performance guarantee, or both.

2. That whatever is stated above is true and correct to the best of my/our knowledge and belief.

DEPONENT(S)

Messrs._____

_____

_____

Official Stamp

Solemnly affirmed before me on this _____day, by the deponent(s) named above with whose identity I am satisfied on the basis of his/her/their CNIC/passport.

COMMISSIONER FOR TAKING AFFIDAVITS

ANNEXURE-VI

TRADING CORPORATION OF PAKISTAN (PRIVATE) LIMITED

BID FORM FOR TENDER NO.TCP/T&R/LOCAL SUGAR/26-1/2026 DATED 27TH NOVEMBER 2026 FOR PURCHASE OF 200,000 MT SUGAR FROM LOCAL SUGAR MILLS

1. **Name & Address of Bidder:** _____
   Telephone: _____
   Fax: _____
   Email: _____
2. **Name & Address of Local Representative in Pakistan:** _____
   Telephone: _____
   Fax: _____
   Email: _____
3. **Quantity & Price:**

S.No	PARTICULARS	Quantity Offered (in MT)	Price (in PKR/MT inclusive of All Taxes including Sales Tax)
1.	**Ex-Mill Price**		
2.	**Delivered at Place (DAP) TCP Pipri Godown basis**		

Please give breakup of the detailed costs of transportation and other charges related to delivery from Ex-Mill to TCP Pipri Godown, Karachi, as follows:

i) Transport: PKR _____/MT
ii) Other Costs: PKR _____/MT
iii) _____.

4. We shall abide by all the terms and conditions of the tender.

5. **Amount of Bid Security: PKR** _____

Banker's Cheque / Bank Guarantee;

No.: _____
Date: _____
Drawn at/issued by**:** _____

Signature: _____
Name: _____
Designation: _____
Date: _____
Stamp: _____

ANNEXURE-VII

Declaration of Ultimate Beneficial Owners Information for Public Procurement Contracts in respect of Tender No. TCP/T&R/Local Sugar/26-1/2026 dated 27th November, 2026:

1. Name
2. Father's Name/Spouse's Name
3. CNlC/NlCOP/Passport No.
4. Nationality
5. Residential address
6. Email address
7. Date on which shareholding, control or interest acquired in the business.
8. In case of indirect shareholding, control or interest being exercised through intermediary companies, entries or other legal persons or legal arrangements in the chain of ownership or control, following additional particulars to be provided:

1	2	3	4	.5	6	7	8	9	10
Name	Legal form (company/limited liability Partnership/ Association of - Persons/Single Member Company/partnership Firm/Trust/Any other individual body corporate (to be specified)	Date of Incorporation/ registration	Name of registering authority	Business Address	Country	Email address	Percentage of shareholding, control or interest of BO in the legal person or legal arrangement	Percentage of shareholding, control or Interest of legal person or legal arrangement in the Company	Identify of natural person who ultimately owns or controls the legal person arrangement

9. Information about the Board of Directors (details shall be provided regarding number of shares in the capital of the company as set opposite respective names).

1	2	3	4	5	6	7	8
Name and surname (In Block Letters)	CNIC No. (in case of foreigner, Passport No.)	Father' s/Husband' s Name in full	Current Nationality (ies)	Any other Nationality (ies)	Occupation	Residential Address in full or the registered / principal office address for a subscribers other than natural	Number of shares taken by cash subscriber (in figures and words)
			Total numbers of shares taken figures and words)				

10. Any other information incidental to or relevant to Beneficial Owner(s).

Name and signature
(Person authorized to issue notice on behalf of the company)



ANNEXURE – VIII

INTEGRITY PACT

Declaration of fees, commission and brokerage payable by the suppliers of goods, services, and works

[the Supplier] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan or any administrative subdivision or agency thereof or any other entity owned or controlled by it (TCP, Ministry of commerce, Government of Pakistan) through any illegal and/or corrupt practices.

Without limiting the generality of the foregoing, [the Supplier] represents and warrants that it has fully declared the brokerage, commission, fees, monies paid, committed or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, Representative, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or including the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from TCP, Ministry of commerce, Government of Pakistan, except that which has been expressly declared pursuant hereto.

[the Supplier] certifies that it has made and shall make full disclosure of all agreements with all persons in respect of or related to the transaction with TCP, Ministry of commerce, Government of Pakistan and has not taken any action or shall not take any action to circumvent the above declaration, representation or warranty.

[the Supplier] accepts full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty by any means whatsoever. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other right and remedies available to TCP, Ministry of commerce, Government of Pakistan under any law, contract or other instrument, be voidable at the option of TCP, Ministry of Commerce, Government of Pakistan.

Not with standing any rights and remedies exercised by TCP, Ministry of commerce, Government of Pakistan in this regard,

[the Supplier] agrees to indemnify TCP, Ministry of Commerce, Government of Pakistan for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to TCP, Ministry of Commerce, Government of Pakistan in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [the Supplier] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from TCP, Ministry of Commerce, Government of Pakistan or any other person in private of and Government agency.

ANNEXURE-IX

BANK GUARANTEE FORM IN RESPECT OF BID SECURITY
(To be furnished on Stamp Paper of appropriate value)

The Trading Corporation of Pakistan (Pvt.) Limited,
Finance & Trade Centre,
Sharea Faisal,
Karachi.

M/s. _____ (hereinafter called the Tenderers) are submitting their offer against Tender No. TCP/T&R/Local Sugar/26-1/2026 dated 27th November 2026 and have requested us to issue a Bank Guarantee for an amount of Rs._____in your favour as earnest money to ensure their compliance with conditions of the Tender.

2. Therefore, we hereby agree to make an unconditional payment of PKR _____ (_____in words) to you on demand without any further question or reference to the Tenderers on the Tender's failure to fulfill the terms of the tender. The sole judge for deciding whether the tenderer has failed to fulfill the terms of the tender shall be Trading Corporation of Pakistan (Pvt.) Limited.

3. This Guarantee is valid up to **_. In case the tenderers are awarded a contract for supply of goods as per Tender quoted above, the Guarantee shall remain in custody of TCP upto the date of furnishing of an acceptable performance bond on TCP's prescribed form.

4. Claim if any must reach us in writing on or before the expiry date after which we shall no longer be liable to make payment to you.

5. Our liability hereunder is limited to US$._____.

Name of Bank_____
Address_____
_____

SIGNATURE
AUTHORIZED OFFICER OF THE BANK

**** Two months from the date of opening of tender.**

ANNEXURE-X

ON JUDICIAL PAPER OF RS.100/-
(DULY ATTESTED BY OATH COMMISSIONER/NOTARY PUBLIC)

Contract No. TCP/T&R/Local Sugar/26-1/2026 December ____, 2026

CONTRACT SALE AND PURCHASE OF WHITE REFINED SUGAR

BUYER: TRADING CORPORATION OF PAKISTAN (PVT.) LIMITED
4TH & 5TH FLOOR, FINANCE & TRADE CENTRE, SHARAH-E-FAISAL,
KARACHI - 74400

SELLER: M/S. _____ Sugar Mills (Pvt.) Limited
Address _____
_____

QUANTITY: _____ MT

PRICE: Rs. _____ PMT (inclusive of all duties and taxes).

DOCUMENTS CONSTITUTING AS INTERGRAL PART AND TERMS & CONDITIONS OF THE CONTRACT:

1. The Notice inviting Tender dated 27th November 2026 **(Annex-A)**, Tender Terms and Conditions dated 27th November 2026 **(Annex-B)**, the Bid dated December _ 2026 **(Annex-C)**, the buyer's confirmation email / letter dated ____ December 2026 **(Annex-D)**, the Award Letter dated ____ December 2026 **(Annex-E)** and the Terms and Conditions defined hereunder shall form as Integral Part and shall together constitute this Contract as the complete Contract between the Parties, and this Contract is to be read in conjunction with the contract documents ibid and annexed herewith.

2. Stamp duty and other costs of executing this Contract shall be borne by the Buyer.

3. This Contract is signed in counterparts, each of which is an original.

IN WITNESS WHEREOF the Parties have signed this Contract on the date first written above.

FOR AND ON BEHALF OF TCP	FOR AND ON BEHALF OF THE BUYER
Signature: _____	Signature: _____
Name:	Name:
Designation:	Designation:
Official stamp:	Official Stamp:

Witnesses

1. Name: _____
   CNIC No.: _____
   Signature: _____

2. Name: _____
   CNIC No.: _____
   Signature: _____

ANNEXURE-XI

TRADING CORPORATION OF PAKISTAN (PVT) LIMITED
4th Floor, Finance & Trade Centre, Shahrah-e-Faisal, Karachi

FORM OF PERFORMANCE BOND
(To be furnished on stamp paper of appropriate value)

Whereas the Trading Corporation of Pakistan (Pvt.) Limited, Block-B, 4th Floor, Finance & Trade Centre, Shahrah-e-Faisal, Karachi (hereinafter referred to as the "BUYER") has accepted offer for the supply of _____ metric tons of wheat to be made by M/s._____ (hereinafter referred to as the "SUPPLIER") on the terms and conditions governing the respective contract.

2. AND whereas the Supplier has requested us **through the Bank** to issue a Guarantee for an amount of PKR_____PAK RUPEES_____(in words)

3. NOW, therefore, in consideration aforesaid, we the _____ Bank Limited, hereby undertake and guarantee due performance of the contract by the Suppliers and compliance with tender terms and conditions of the tender in all respects and we unconditionally and absolutely bind ourselves to the following:

i. To make payment of Pak Rupees _____ to the Buyer, or as directed by the Buyer on the date of their receipt of demand in writing without any question whatsoever.

ii. To keep this guarantee valid and in force for One (01) month after execution of contract including settlement of all claims.

iii. To extend this guarantee for such further period or periods as may be required by the Buyer at the Buyer's sole discretion, five days before the expiry of the validity date.

4. We understand that this guarantee is unconditional and that the sole judge for deciding whether the Supplier has performed the contract No. TCP/T&R/Local Sugar/26-1/2026 dated 27th November 2026 and fulfilled the terms and conditions of the contract, shall be the Buyer.

5. We further understand that any grant of time or indulgence to the Supplier without reference to us shall not in any manner absolve us from liability to make payment to the Buyer as stipulated under this Guarantee.

6. Our commitment under this guarantee is limited to an amount of PKR_____ PAK Rupees_____(in words).

7. This guarantee is valid for 180 days.

SIGNED _____
DATED _____
PLACE _____
(A first class scheduled Bank of Pakistan)



PS:1822/SARS 0007-2021
(ICS No. 67.180.10)

PAKISTAN STANDARD SPECIFICATION

FOR

REFINED SUGAR

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PAKISTAN STANDARDS AND QUALITY CONTROL AUTHORITY
Standards Development Centre,
PSQCA Complex, Standardization Wing II, 1st Floor, Plot - ST-7/A, Block-3,
Scheme No.36, Gulistan-e-Jauher, Karachi.

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0. FOREWORD

0.1 This Pakistan Standard Specification was adopted by the Pakistan Standards & Quality Control Authority on **03-03-2021** after the finalized by the Sugar Industries Technical Committee had been approved by the National Standards Committee for Agriculture & Food Products.

0.2 In order to keep abreast of the Progress in Industry the Pakistan Standards are subject to periodical review suggestions for improvement shall always be welcomed and put to the relevant committee for its consideration.

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SAARC STANDARD

SARS 0007:2017

First edition
01-03-2017

REFINED SUGAR — SPECIFICATION

ICS 67.180.10

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SAARC
SARSO

Reference number
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FOREWORD

The South Asian Regional Standards Organization (SARSO) is a Specialized Body of South Asian Association for Regional Cooperation (SAARC) aimed to achieve and enhance coordination and cooperation among SAARC Member States in the fields of standardization and conformity assessment and to develop harmonized Standards for the South Asian region to facilitate intra-regional trade and to have access in the global market. The Member States of SAARC are Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. The Agreement on the establishment of SARSO entered into force with effect from 25 August 2011 after ratification by all Member States of SAARC.

The National Standards Bodies of the SAARC Member States participate in the development of SAARC Standards (SARS) through the Sectoral Technical Committees (STCs). The SARS are developed through consensus and are drafted in accordance with the editorial rules of the SARSO Directives, Part 2.

The SARSO Secretariat is the guardian of the authoritative versions of the SAARC Standards and is responsible for keeping master texts of SAARC Standards, both in hard and soft form. The Member States are responsible for making SAARC Standards available for sale, distribution, etc, at the national level. In accordance with the 'SAARC Agreement on Implementation of Regional Standards', the approval of a SAARC Standard implies that Member States have an obligation to give it the status of a National Standard.

This SAARC Standard was considered by the Technical Management Board and approved by the Governing Board of SARSO on the recommendation of the STC-01: Food and Agricultural Products.

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INTRODUCTION

Refined sugar is manufactured from any type of sugar or sugar cane or sugar beet, in general by a process of purification, consisting broadly of affination, melting, chemical treatment, filtration, decolourization and subsequent recrystallization in vacuum pan, the treatment depending upon the nature of the initial material. It may be of any grain size (large, medium or small).

This Standard is aligned with the Codex Standard for Sugars, CODEX STAN 212 - 1999 and the methods of test have been aligned with the International Commission for Uniform Methods of Sugar Analysis (ICUMSA).

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, as per the relevant national Standards of the respective Member State. The number of significant places retained in the rounded off value should be the same as that of the specified value in the relevant referred Standard

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SAARC Standard

REFINED SUGAR — SPECIFICATION

1 SCOPE

This Standard specifies the requirements and the methods of sampling and test for refined sugar.

2 NORMATIVE REFERENCES

The Standards referred in the text, if any, contain provisions which through reference in this text constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All Standards are subject to revision and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the Standards referred in the text.

3 TERMS AND DEFINITIONS

For the purposes of this Standard, the following term and definition apply.

3.1 Refined Sugar

Purified and crystallized sucrose (saccharose)

4 REQUIREMENTS

4.1 Description

Refined sugar shall be crystalline, white, odourless and free from dirt, iron fillings and other extraneous matter.

4.2 The product shall also comply with the requirements given in Table 1.

4.3 Refined sugar shall be manufactured, packed, stored and distributed under hygienic conditions as detailed in the respective National Standards. In case such National Standards are not available, the Codex Alimentarius Commission Standards on the hygienic conditions shall be followed.

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Table 1 - Requirements for Refined Sugar
(*Clause* 4.2)

Sl. No.	Characteristics	Requirement	Method of Test, Ref to Annex
(1)	(2)	(3)	(4)
i)	Loss on drying, percent by mass, *Max*	0.10	B
ii)	Polarization, *Min*	99.7°Z	C
iii)	Reducing sugar, percent by mass, *Max*	0.04	D
iv)	Colour in ICUMSA units, *Max*	60	E
v)	Conductivity ash, percent by mass. Max	0.04	F
vi)	Sulphur dioxide, mg/kg, *Max*	15	G
vii)	Lead, mg/kg, *Max*	0.5	AOAC 999.10 H (alternative method)
viii)	Chromium, mg/kg, *Max*	20	I
ix)	Copper, mg/kg, *Max*	2	AOAC 960.40 or AOAC 999.10

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1

x)	Arsenic mg/kg, *Max*	1	AOAC 986.15 or ICUMSA , GS2/3-23 (2005)

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5 PACKAGING

Refined sugar shall be packaged in clean, sound and new jute bags or bags made of polypropylene or bags made of high density polypropylene made of food grade material. The jute bags may be lined with polyethylene film. The mouth of each bag shall be either machine-stitched or rolled over and hand-stitched. If hand-stitched, the stitches shall be in two rows with at least 14 stitches in each row. In the case of smaller consumer packs, the product shall be packed in food grade plastics or any other suitable non-toxic material.

6 MARKING/LABELLING

6.1 Each bag/pack shall bear legibly and indelibly the following particulars:

a) name of the product;

b) brand name or Trade name, if any;

c) name and address of the manufacturer including the country of origin;

d) in case of imports, the name and address of importer;

e) net mass of sugar;

f) month and year of manufacture;

g) batch or Code number;

h) the words 'Best before . . . .' (month and year to be indicated); and

i) any other markings as specified as per respective national regulations.

6.2 Certification Marking

The product may also be marked with the Standard Mark of conformity.

7 SAMPLING

Representative samples of refined sugar shall be drawn and the criteria for conformity to this Standard shall be established, according to the method prescribed in Annex A. In case of consumer packs, samples of refined sugar shall be drawn and the criteria for conformity to this Standard shall be established.

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Annex A
(Normative)
(*Clause* 7)

SAMPLING OF REFINED SUGAR

A-1 General Requirements

A-1.0 In drawing, preparing, storing and handling samples, the following precautions and directions shall be observed.

A-1.1 The sample shall be taken in a protected place not exposed to damp air, dust or soot.

A-1.2 The sampling instrument shall be clean and dry when used.

A-1.3 Precautions shall be taken to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination.

A-1.4 The samples shall be placed in clean, dry and moisture-proof containers.

A-1.5 The sample containers shall be sealed air-tight after filling and marked with full details of sampling, that is, name of the material, the date of sampling, month and year of manufacture, name of the producer, name of the person carrying out the sampling and such other particulars as considered necessary.

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A-2 Scale of Sampling

A-2.1 Lot

All the bags in a single consignment of the material drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared to consist of different batches of manufacture, the batches shall be marked separately and the group of bags in each batch shall constitute separate lots.

A-2.1.1 Each lot shall be tested for ascertaining the conformity of refined sugar to the requirement of this Standard.

A-2.2 The number of bags to be selected for sampling shall be in accordance with column 2 and 3 of Table 2.

Table 2 - Number of Bags to be selected for Sampling
***(Clause* A-2.2)**

Sl. No.	No. of Bags in each Lot	No. of Bags to be Selected
(1)	(2)	(3)
i)	2-25	2
ii)	26-100	3
iii)	101-500	5
iv)	501-1000	7
v)	1001 and above	8

A-2.3 These bags shall be selected at random from the lot.

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A-3 Test Samples and Referee Sample

From the top, middle and bottom portions of each of the selected bags (*see* A-2) approximately equal quantity of the sugar shall be taken with the help of a suitable sampling instrument. The sample collected from each of the bags shall be mixed thoroughly to constitute a composite sample of 600 g. The composite sample thus prepared shall be divided approximately into three equal parts; one for the purchaser, one for the supplier and the third for the referee; and sealed air-tight with the particulars as given in A-1.5.

A-4 Number of Tests

The composite sample prepared as under A-3 shall be tested for the characteristics as prescribed in Table 1.

A-5 Criteria for Conformity

The lot shall be declared as conforming to this Standard when the test results on various characteristics obtained on the composite sample satisfy the corresponding requirements as specified in clause 4 and Table 1. When examined each pack shall conform packaging and marking/labeling requirements.

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Annex B
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (i)]
DETERMINATION OF LOSS ON DRYING

B-1 Field of Application

The method is applicable to various types of sugar and sugar products.

B-2 Definition

B-2.1 Loss on Drying — Because water represents the primary heat-volatile liquid in both cane and beet processing it is certainly the main volatile component lost on drying sugar. The matter lost on drying in this method is referred to as 'moisture' or water. Moisture in sugar is considered to be present in three forms:

a) Free moisture, being that contained on the surface of the crystal which is easily and quickly removed on drying.

b) Bound moisture, being that contained in the glassy layer on the surface and in the reentrant angles which is only released slowly as the glass crystallizes.

c) Inherent moisture, this being moisture included within the crystal structure and only released in general by grinding.

B-3 Principle

The principle of the method is oven drying using the atmospheric pressure oven technique (105°C) followed by standardized conditions for cooling after oven drying. It is mainly free moisture which is estimated by this method.

B-4 Apparatus

B-4.1 Forced Draught Atmospheric Pressure Oven, maintained at a temperature of 105°C ± 2°C as measured at a distance of 2.5 cm ± 0.5 cm above the dishes in the test. The oven is to be ventilated and the circulation fan faced with an inter-lock switch which opens when the oven door is opened.

B-4.2 Desiccator, containing self-indicating silica gel.

B-4.3 Dishes with Tight Fitting Lids — These should have a diameter of 6cm to 10cm and a depth of 2 cm to 3 cm. Although they may be made of glass, platinum or nickel, aluminum is recommended. The thickness of the dishes is optional except that due regard should be paid to the weight of the dish in relation to the weight of the sample and to the loss to be determined.

B-4.4 Clean Dry Duster

B-4.5 Surface Pattern Dial Thermometer — An electronic thermometer may be used provided it is fitted with a surface probe.

B-4.6 Analytical Balance — Capable of weighing to the nearest 0.1 mg.

B-5 Procedure

B-5.1 Drying

Carry out the determination in duplicate and preheat the oven to 105°C. Place the empty dishes with lids open in the oven for not less than 30 min. using the duster for handling them, remove the dishes from the oven,

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replace the lids and place in the desiccator. Place the contact thermometer on top of one of the dishes. When the temperature of the dishes has fallen to ambient ± 2°C, weigh them as rapidly as possible to an accuracy of ± 1 mg. As rapidly as possible, place 20 g to 30 g of the sample into each dish, replace the lids and weigh the dish and contents to an accuracy of 0.1 mg. Return the dishes with the lids open to the oven. Their position in the oven will be governed by the requirements of B-4.1. Dry the sample for 3 h exactly. Ensure that there are no other materials in the oven during the drying period.

NOTE: The depth of the sugar in the dish must not exceed 1 cm.

B-5.2 Weighing to Determine Loss on Drying

Replace the lids, remove the dishes from the oven and place in the desiccator with the contact thermometer on one of them. Cool the dishes, until the thermometer indicates a temperature of ambient ± 2°C. Weigh the dishes to an accuracy of 0.1 mg.

NOTE: No attempt should be made to dry to constant weight and care must be taken to ensure that there is no physical loss of sugar at any stage. Dishes should always be held with a clean, dry duster.

B-6 Expression of Results

B-6.1 Calculation of Loss on Drying

Loss in mass is expressed as a percentage or the original oss in mass is expressed as a percentage of the original mass of the sample, that is:

$$\text{Loss on drying, percent by mass} = \frac{100(m_2\text{-}m_3)}{m_2\text{-}m_1}$$

where

m_1 is the mass of dish, in g;
m_2 is the mass of dish with sugar before drying, in g; and
m_3 is the mass of dish with sugar after drying, in g.

Duplicate results are acceptable if neither is outside the limits of $\pm$ 10 percent of the mean value for the test. Tests in which either duplicate exceeds this limit should be repeated.

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Annex C
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (ii)]

DETERMINATION OF POLARIZATION

C-1 Field of Application

The method is applicable to plantation white sugar and refined sugar. The method is used in statutory analysis and is applicable to white sugars and other white refined products of low colour and turbidity, not needing clarification and having a loss on drying of not more than 0.1 percent. White sugars, the polarization of which cannot be measured without clarification, are to be measured according to method prescribed for raw sugars (*see 6*).

C-2 Apparatus and Glassware

C-2.1 Analytical Balance

C-2.2 Normal Weight, 26.000 g (brass weight) as weighed in air at 20°C.

C-2.3 Basin, made of nickel or German silver, large enough to hold the normal weight of sugar.

C-2.4 Volumetric Flask, of capacity 100 ml, calibrated at 20°C.

C-2.5 Long-Stemmed Funnel, with a stem long enough to extend below the neck of the volumetric flask.

C-2.6 Stemless Funnel, capable of holding 100 ml.

C-2.7 Glass Cylinder, capable of holding 100 ml.

C-2.8 Watch-Glass, large enough to cover the stemless funnel.

C-2.9 Saccharimeter, graduated in International Sugar Scale and provided with a 200 mm tube. The saccharimeter should be sheltered in a cabinet, the inside of which is maintained at 20°C. Where this is not possible, necessary corrections shall be applied, based on the characteristics of the particular instrument.

C-2.9.1 Standardization of saccharimeter scale — Saccharimeter scale must be graduated in conformity with International Sugar Scale adopted by ICUMSA. Rotations of this scale are designated as degrees sugar (^{o}S).To convert values in ^{o}S to values in ^{o}Z, multiply the ^{o}S value by the factor 0.999 71. Basis of calibration of 100^{o} point on international sugar scale is polarization of normal solution of pure sucrose (26.000 g/100 ml) at 20^{o}C in 200 mm tubes. This solution, polarized at 20^{o}, must give saccharimeter reading of exactly 100^{o}S.

C-2.9.2 Standardization of polarimeter scale – Polarimeter will be calibrated with traceable quartz plates for 100^{o}Z.

C-3 Reagent

C-3.1 Alumina Cream — Dilute 500 ml of 30 percent (w/v) aluminium sulphate solution to 2 litres. Add gradually 10 percent (w/v) ammonia solution to the above with constant stirring until no precipitate is formed. Allow the precipitate to settle and decant off the clear liquid. Shake the precipitate with 1 litre of distilled water and allow it to settle again for decantation of the clear liquid. Repeat the process of washing and decantation till the supernatant liquid is neutral to litmus and does not precipitate with barium chloride solution. Make the precipitate of the aluminium hydroxide into a thick paste with water and store it in a stoppered bottle.

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C-3.2 Lead Acetate

Dissolve 560 g of basic lead acetate powder in 1 litre of freshly boiled distilled water, which has been previously cooled in a sealed container. Boil for 30 minutes and allow to settle overnight in a sealed container. Decant the supernatant liquid and dilute with freshly boiled distilled water to 1.25 specific gravity (56° Brix).

C-4 Test Temperature

The polarization of the normal solution of sugar shall be carried out at 20°C, as far as possible.

C-5 Procedure

C-5.1 Preparation of the Solution

Weigh accurately on the analytical balance the normal weight of the sugar (*see* C-2.2) in the basin. Transfer this quantity to the volumetric flask with the aid of the long-stemmed funnel. Rinse the basin and the funnel with water, and transfer the washings to the volumetric flask taking care that the volume of the contents of the flask does not exceed 80 ml. Bring the sugar into solution by gently swirling the flask and clarify the solution by adding 1 ml to 2 ml of alumina cream until nearly all the impurities have been precipitated. Make up the volume to 100 ml at the test temperature (*see* C-4) with water. If difficulty in clarification is experienced, repeat the experiment using anhydrous lead sub-acetate in small quantities in place of alumina cream (about 0.6 g of lead sub-acetate is usually required; any excess of lead sub-acetate should be avoided).

C-5.2 Polarization of the Solution

Place the stemless funnel over the glass cylinder and fix a cone of dry filter paper, large enough to hold 100 ml, in the funnel. Pour the whole of the defecated solution on to the cone of dry filter paper and cover it immediately with a watch-glass large enough to cover the funnel. Reject the first 10 ml to 15 ml of the filtrate. Rinse the glass cylinder with a little quantity of the filtrate; discard the solution used for rinsing. Collect the remainder of the filtrate into the rinsed cylinder. Polarize the filtrate in the saccharimeter at 20°C, as far as possible (*see also* C-2.1), using a 200 mm tube. The reading gives the polarization percent of the sugar.

C-5.2.1 If the polarization is done at a temperature other than 20°C, the saccharimeter reading shall be corrected using the following formula (*see* Note):

$$P^{20} = P^{t}[1+0.0003\ (t - 20)]$$

Where

P^{20} is saccharimeter reading, at 20°C,
P^{t} is saccharimeter reading, at t°C, and
t is temperature in °C at which the polarization is carried out.

NOTE: The formula is applicable only up to 30°C

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Annex D
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (iii)]

DETERMINATION OF REDUCING SUGARS BY THE MODIFIED OFNER TITRIMETRIC METHOD

D-1 Field of Application

The method measures the reducing power of solutions of white sugar containing reducing substances, for example, invert sugar in a weak alkaline solution of a Cu^{++} complex with tartrate. The method is applicable to various types of sugar and sugar products.

D-2 Definition

D-2.1 Reducing Sugars — Mono and oligosaccharides containing a free aldehydic or ketonic group which show a reducing effect on certain oxidizing agents.

D-2.2 Invert Sugar — Equi-molar solution of glucose and fructose.

D-2.3 Reducing Substances — The sum of reducing sugars and other substances in sugar products defined by their reducing power on reagents which are used for the determination of reducing sugars. Like reducing sugars their amount is in most cases expressed as the equivalent amount of invert sugar, that is the amount of invert sugar which shows the same reducing power under the conditions of the reaction.

D-3 Principle

The complex formed between Cu^{++} ions and potassium sodium tartrate is reduced by reducing sugars to univalent Cu^{+} which is precipitated as Cu_2O. The precipitated Cu_2O is then determined by iodometric titration.

The Cu_2O is oxidized by an excess is back-titrated with sodium thiosulphate. The reaction between the reducing sugars and the Cu^{++} complex is not stoichiometric. The amount of Cu_2O formed depends upon the prescribed reaction conditions which therefore must be strictly followed. It has been determined that 1 ml of 0.016 15 mol/l iodine solution is equivalent to 1mg of reducing sugars, once the correction for the reducing effect of sucrose has been taken into account.

D-4 Reagents and Materials

Use only distilled water or water of similar quality. All reagents should be of analytical grade of better unless stated.

D-4.1 Activated Carbon, powdered.

D-4.2 Small Pumice Pieces

D-4.3 Disodium Hydrogen Phosphate, $Na_2HPO_4.12H_2O$

D-4.4 Glacial Acetic Acid, M_{20} = 1.05 g/ml.

D-4.5 Acetic Acid Solution, approximately 5 mol/l.

D-4.6 Potassium Sodium Tartrate (Rochelle or Seignette Salt)

D-4.7 Copper Sulphate Pentahydrate, $CuSO_4.5H_2O$.

D-4.8 Sodium Carbonate, anhydrous.

D-4.9 Soluble Starch

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D-4.10 Hydrochloric Acid, approximately 1 mol/l.

D-4.11 Hydrochloric Acid, approximately 2 mol/l.

D-4.12 Ofner Solution, modified — Weigh out 7.0 g copper sulphate pentahydrate (*see* D-4.7*)* 10.0 g sodium carbonate (*see* D-4.8), 300 g potassium sodium tartrate (*see* D-4.6) and 50 g disodium hydrogen phosphate (*see* D-4.3) in a 1000 ml flask. Dissolve in approximately 900 ml water (heating slightly to dissolve if necessary). Heat the solution for 2 h in a boiling water bath. Cool down to room temperature and fill up to the mark. Add approximately 10 g activated carbon (*see* D-4.1) and stir for 5-10 min. Filter the solution (*see* D-5.11).

D-4.13 Potassium Iodate Solution, 0.016 67 mol/l — Weigh out 3.566 7 g potassium iodate, KIO_3. Transfer to a 1000 ml volumetric flask, dissolve in water and fill to the mark.

NOTE: Dry the potassium iodate for 3 h at 100°C before use.

D-4.14 Starch Solution Indicator for Iodine — Dissolve 1 g of soluble starch in 100 ml saturated sodium chloride solution. Bring the solution to the boil for few minutes.

D-4.15 Potassium Iodide, KI

D-4.16 Sodium Thiosulphate Solution, 0.033 3 mol/l — Dilute a 0.1 mol/l sodium thiosulphate solution three fold with water and standardize with potassium iodate. Dissolve 2 g of potassium iodide in 10 ml water. Add 5 ml of approximately 2 mol/l hydrochloric acid (*see D*-4.11) and 10 ml of 0.016 67 mol/l potassium iodate solution (*see D*-4.13). Cover the flask with a watch glass, shake gently and leave the solution in the dark for approximately 30 min. Titrate the iodine formed with the sodium thiosulphate solution to complete decolonization, adding 1 ml of starch indicator (*see D*-4.14) immediately before the end point. Calculate the factor f_{Th} of the thiosulphate solution:

$$f_{Th} = \frac{30.96}{V_{Th}}$$

where

V_{Th} is ml of sodium thiosulphate solution titrated.

NOTE: f_{Th} corrects the used iodine solution to the experimentally determined value of 0.016 15 mol/l, for which 1 ml corresponds to 1 mg reducing sugars.

D-4.17 Iodine Solution, 0.016 67 mol/l - Dilute a 0.05 mol/l iodine solution three-fold with water and standardize with the 0.033 3 mol/l sodium thiosulphate solution (*see* D-4.16). Pipette 25.0 ml of the iodine solution into a 300 ml Erlenmeyer flask. Add 5 ml of 5 mol/l acetic acid (*see* D-4.5) and, after gently shaking the mixture, titrate back with the 0.033 3 mol/l sodium thiosulphate solution (*see* D-4.16). Add 1 ml of starch indicator (*see* D-4.14) just before the endpoints is reached. Calculate the factor, f_1 of the iodine solution:

$$f_1 = \frac{V_{Th} \times f_{Th}}{25}$$

where

V_{Th} is ml of sodium thiosulphate solution titrated, and
f_{Th} is Correction factor for the sodium thiosulphate solution.

D-5 Apparatus and Glassware

D-5.1 Analytical Balance, capable of weighing to the nearest 0.1 mg.

D-5.2 Precision Balance, capable of weighing to the nearest 0.1 g.

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D-5.3 Burettes, capacity 50 ml,

D.5.4 Erlenmeyer Flasks, capacity 300 ml.

D-5.5 Volumetric Flasks, 1 000 ml and 200 ml.

D-5.6 Pipettes, capacities 1 ml, 15 ml and 50 ml.

D-5.7 Watch Glasses, to cover Erlenrneyer flasks.

D-5.8 Bunsen Burner, Tripod and Wire Gauze

D-5.9 Boiling Water Bath

D-5.10 Water Bath with Cold Running Water

D-5.11 Filter Paper

D-6 Procedure

D-6.1 Preparation of the Sample

The solution prepared for the determination should contain no more than 25 mg invert sugar in 50 ml. This requires that 40 g of white sugar be made up with water to 200 ml.

D-6.2 Hot Value

Mix 50.0 ml of the prepared solution (*see* D-6.1) with 50.0 ml of the Ofner solution (*see* D-4.12). Add some pumice pieces (*see* D-4.2) to the mixture. Bring the mixture to the boil within 4 to 5 min using the Bunsen burner, the tripod and the wire gauze. Boil for exactly 5 min. Note the start of boiling is once numerous steam bubbles break over the whole surface. Cool the mixture down in a water bath with cold running water. After approximately 10 min. the mixture should have reached room temperature. Add 1 ml concentrated acetic acid (*see* D-4.4). Add iodine solution (*see* D-4.17) until the colour of the mixture turns a typical iodine colour. This procedure dissolves the formed Cu_2O with an excess of iodine. The surplus iodine should be so high that between 10 ml and 15 ml of sodium thiosulphate (*see* D-4.16) are consumed on back titration. Add 15 ml of the 1 mol/l hydrochloric acid (*see* D-4.10) by pouring it down the inner side of the flask so that the residual droplets are washed down into the solution. Cover the flask with a watch glass and move it gently for 2 min until the precipitate of Cu_2O is completely dissolved. Titrate the sample with 0.033 3 mol/l sodium thiosulphate (*see* D-4.16). Add 1 ml of starch solution immediately before the endpoint is reached. Repeat the above procedure with another prepared solution mixed with Ofner solution and record the average of the two replicated V_1, and V_2 for iodine and thiosulphate respectively.

D-6.3 Cold Value

Mix 50.0 ml of the prepared sample (*see* D-6.1) with 50.0 ml of the Ofner solution (*see* D-4.12). Leave the mixture at room temperature for 10 min. Repeat the procedure outlined in D-6.2. Record values V_3 and V_4.

D-6.4 Blank Value

Mix 50 ml of water with 50 ml of the Ofner solution (*see* D-4.12). Repeat the procedure outlined in D-6.2. Record the values V_5 and V_6.

NOTE: It is essential that the time between addition of iodine solution and beginning of the back titration is equal for the hot value and the cold value.

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D-7 Expression of Results

D-7.1 Calculation of the Results

Added amount of iodine for hot value = V_1

Added amount of thiosulphate for hot value = V_2

Added amount of iodine for cold value = V_3

Added amount of thiosulphate for cold value = V_4

Added amount of iodine for blank value = V_5

Added amount of thiosulphate for blank value = V_6

Corrected consumption of 0.016 67 mol/l iodine solution:

Calculated hot value, $A = (V_1 \times f_1) – (V_2 \times f_{Th})$

Calculated cold value, $B = (V_3 \times f_1) - (V_4 \times f_{Th})$

Calculated blank value, $C = (V_5 \times f_1) - (V_6 \times f_{Th})$

where

f_1 is the factor of the iodine solution. Calculated in D-4.17 and

Sucrose correction, D, is 0.1 ml iodine solution/g of sucrose in the reaction mixture.

$$\text{Invert sugar, mg/kg} = \frac{(A - B - C - D) \times 1000}{s}$$

where

s is the amount of sample in 50 ml of prepared solution (*see* D-6.1)

D-7.2 Example Calculation

100 g white sugar is weighed out and diluted to 200 ml. 50 ml of this solution contains 25 g sucrose.

Amount of iodine solution added to hot value is 25.00 ml.

Amount of sodium thiosulphate consumed is 21.71 ml.

Amount of iodine solution added to cold value is 25.00 ml.

Amount of sodium thiosulphate consumed is 24.72 ml.

Amount of iodine added to the blank value is 25.00 ml.

Amount of sodium thiosulphate consumed is 25.00 ml.

f_{Th} is calculated to be 1.029

f_1 is calculated to be 1.031

$B = (25.0 \times 1.031) – (24.72 \times 1.029) = 0.34$

$A = (25.0 \times 1.031) – (21.71 \times 1.029) = 3.43$

$C = (25.0 \times 1.031) – (25.0 \times 1.029) = 0.05$

$D = 25.0 \times 0.1 = 2.50$

$$\text{Reducing sugar} = \frac{(3.43\text{-}0.34\text{-}0.05\text{-}2.50) \times 1000}{25} = 21.9 \text{ mg/kg}$$

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Annex E
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (iv)] DETERMINATION OF SUGAR SOLUTION COLOUR

E-1 Field of Application

This method is used for the determination of sugar solution colour. The method can be applied to all crystalline or powdered white sugars provided that a filtered test solution can be prepared by the procedure specified in the method. The method is not suitable for those sugars which contain colouring matter, turbidity or additives to an extent that filtration is not practical.

E-2 Definitions

E-2.1 Transmittance of a Solution

If I_1 represents the radiant energy incident upon the first surface of the solution and I_2 represents the radiant energy leaving the second surface of the solution.
Then

$$\text{Transmittance of the solution, } T = \frac{I_2}{I_1}$$

where

100 *T* is percentage transmittance

E-2.2 Transmittancy

Let T_{soln}, represent the transmittance of a cell containing the solution and let T_{solv} represent the transmittance of the same or duplicate cell containing the pure solvent.
Then

$$\text{Transmittancy of the solution, } T_S = \frac{T_{soln}}{T_{solv}}$$

E-2.3 Absorbency (Extinction), *As*

$$\text{Absorbancy of the solution, } \blacksquare = -\log_{10} T_s$$

E-2.4 Absorbance Index (Extinction Index)

Let b represent the length, cm, of the absorbing path between the boundary layers of the solution and let *c* represent the concentration, g/ml, of the sugar solution.
Then,

$$\text{Absorbance index of the solution, } \blacksquare = \frac{\blacksquare}{\blacksquare\blacksquare}$$

E-2.5 International Commission for Uniform Methods of Sugar Analysis (ICUMSA) Colour

The value of the absorbance index multiplied by 1000 is reported as ICUMSA Colour. The resulting values are designated as ICUMSA Units (IU).

E-3 Principle

White sugar is dissolved in a distilled water to give a 50 percent sugar solution. The solution is filtered through a membrane filter to remove turbidity. The absorbance of the filtered solution is measured at a wavelength of 420 nm and the solution colour is calculated.

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E-4 Reagents

Use only distilled water or water of equivalent purity.

E-5 Apparatus

E-5.1 Instrument — Spectrophotometer or calorimeter capable of light transmission measurements at a wavelength of 420 nm with the narrowest practical bandwidth, for example ± 10 nm. The instrument should be fitted with a grating, prism or interference filter monochromator. Coloured glass of gelatin filters are not satisfactory.

E-5.2 Associated Optical Cells — Use a cell of at least 4 cm in length. A cell length of 10 cm or more is to be preferred for low colour white sugars. A second or reference cell may be used provided that a test with distilled water has shown that the two cells are within 0.2 percent of being identical.

E-5.3 Membrane Filters — Pore size 0.45 mm of cellulose based material.

E-5.4 Membrane Filter Holder — Preferably fitted with a stainless steel support.

E-5.5 Vacuum Oven, Vacuum Desiccator or Ultrasonic Bath, for de-aeration of the filtered sugar solution.

E-5.6 Refractometer

E-5.7 Laboratory Balance — Capable of weighing to the nearest 0.1 g.

E-6 Procedure

E-6.1 Sample Preparation

Mix the sample of sugar thoroughly. Weigh 50.0 ± 0.1 g of the sample into a 250 ml conical flask and add 50.0 ± 0.1 g of distilled water and dissolve by swirling at room temperature. Filter the sample solution under vacuum through a membrane filter (*see* E-5.3) into a clean dry conical flask. De-aerate the filtered solution for 1 hour at room temperature in a vacuum oven or an evacuated desiccator. Alternatively de-aerate by immersing the conical flask, containing the sugar solution, in an ultrasonic bath for 3 min. Measure the refractometric dry substance (RDS) of the solution, to an accuracy of ± 0.1 g/100 g by the method given in Annex J.

E-6.2 Colour Measurement

Set up the colour measuring instrument (*see* E-5.1) according to the manufacturer's instructions and adjust the wavelength to 420 nm. Rinse the measuring cell with sugar solution and then fill. Determine the absorbancy (*As* or $-\log_{10}Ts$) of the solution using filtered de-aerated distilled water as the reference Standard for zero colour.

E-7 Expression of Results

E-7.1 Calculation

Calculate the concentration of sample solids from the RDS measured in E-6.1 using Table 3.

$$\text{ICUMSA Colour} = \frac{1000 \times As \quad \text{IU}}{bc}$$

where

As is absorbance,
b is cell length in cm, and
c is concentration

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Table 3- Concentration of Sample Solids from the RDS Percentage

RDS percent	cg/cm^3	RDS percent	cg/cm^3
(1)	(2)	(1)	(2)
45.0	0.541 178	50.1	0.616 333
45.1	0.542 621	50.3	0.619 348
45.2	0.544 064	50.4	0.920 857
45.3	0.545 509	50.5	0.622 368
45.4	0.546 955	50.6	0.623 880
45.5	0.548 402	50.7	0.625 393
45.6	0.549 851	50.8	0.626 907
45.8	0.552 752	50.9	0.628 423
45.9	0.554 204	51.0	0.629 940
46.0	0.555 657	51.1	0.631 459
46.1	0.557 112	51.3	0.634 500
46.2	0.558 568	51.4	0.636 022
46.3	0.560 025	51.5	0.637 546
46.4	0.561 483	51.6	0.639 070
46.5	0.562 943	51.7	0.640 597
46.6	0.564 404	51.8	0.642 124
46.8	0.567 330	51.9	0.643 653
46.9	0.568 794	52.0	0.645 183
47.0	0.570 260	52.1	0.646 715
47.1	0.571 728	52.2	0.648 248
47.2	0.573 196	52.3	0.649 782
47.3	0.574 666	52.4	0.651 317
47.4	0.576 137	52.5	0.652 854
47.5	0.577 609	52.6	0.654 392
47.6	0.579 082	52.7	0.655 932
47.8	0.582 033	52.8	0.657 472
47.9	0.583 510	52.9	0.659 015
48.0	0.584 989	53.0	0.660 558
48.1	0.586 469	53.1	0.662 103
48.2	0.587 950	53.2	0.663 649
48.3	0.569 432	53.3	0.665 196
48.4	0.590 916	53.4	0.666 745
48.5	0.592 401	53.5	0.668 295
48.6	0.593 887	53.6	0.669 846
48.7	0.595 374	53.7	0.671 399
48.9	0.598 353	53.8	0.672 953
49.0	0.599 844	53.9	0.674 509
49.I	0.601 337	54.0	0.676 065
49.2	0.602 83 I	54.1	0.677 624
49.3	0.604 326	54.2	0.679 183
49.4	0.605 822	54.3	0.680 744
49.5	0.607 320	54.4	0.682 306
49.6	0.608 819	54.5	0.685 434
49.7	0.610 319	54.6	0.687 000
49.8	0.611 821	54.7	0.688 568
49.9	0.613 324	54.8	0.688 568
50.0	0.614 828	54.9	0.690 137

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Annex F
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (v)]
DETERMINATION OF CONDUCTIVITY ASH

F-1 Field of Application

The conductivity ash in solutions gives measure of the concentration of ionized soluble salt present in solutions of low conductivity. This method is applicable to plantation white sugar, refined sugar and other types of sugars.

F-2 Definition

F-2.1 Conductivity Ash — The ash determined conductimetrically, known as conductivity ash cannot be directly compared with the gravimetric ash determined by incineration and weighing of the ash. Conductivity ash has its own individual significance. The factors for converting conductivity to ash are chosen in such a way that the conductivity ash value corresponds approximately to values for sulphated ash. This coefficient is conventional and cannot be experimentally verified.

F-3 Principle

The specific conductivity of a white sugar solution at a concentration of 28 g/100 g is determined. The equivalent ash is calculated by the application of a conventional factor.

F-4 Reagents

F-4.1 Purified Water — For preparation of all solutions (sugar and potassium chloride) use twice-distilled or deionized water with a conductivity of less than 2 µS/cm.

F-4.2 Potassium Chloride, 0.01 mol/l — Weigh out 745.5 mg after first dehydrating by heating to 500°C (dull red heat). Dissolve in water in a 1 litre volumetric flask and make up to the mark.

F-4.3 Potassium Chloride, 0.000 2 mol/l — Dilute 10 ml of potassium chloride solution, 0.01 mol/l (*see* F-4.2) and make up to the mark in a 500 ml volumetric flask. This solution has a conductivity of (26.6 ± 0.3) µS/cm at 20°C (after deduction of the specific conductivity of the water used).

F-5 Apparatus and Glassware

F-5.1 Sugar Ash Bridge, Null Balance Bridge or Conductivity Meter

F-5.2 Volumetric Flasks, 100, 500 and 1 000 ml.

F-5.3 Pipettes, 10 ml

F-5.4 Analytical Balance - Capable of weighing to the nearest 0.1 mg.

F-6 Procedure

Dissolve 31.3 g ± 0.1 g of sugar in water in a 100 ml volumetric flask and make up to volume at 20°C (or dissolve 28.0 g ± 0.1 g of sugar in water to give a solution of mass 100.0 g). In the case of liquids, the amount taken must be such that the test solution contains 31.3 g of solids/100 ml, or 28.0 g solids/100 g of solution. After thorough mixing, transfer the solution into the measuring cell and measure the conductivity at 20°C ± 0.2°C. Check the measurement using the reference solution (*see* F-4.3).

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F-7 Expression of Results

F-7.1 Calculation of Results

If C_1 is the measured conductivity in µS/cm at 20°C and if C_2 is the specific conductivity of the water at 20°C, then the corrected conductivity (C_{28}) of the 28 g/100 g solution is:

$$C_{28} = C_1 - 0.35\, C_2$$

and

$$\text{Conductivity ash, percent} = 6 \times 10^{-4}{}_{28} \times C$$

F-7.2 Temperature Correction

If the determination cannot be made at the standard temperature of 20°C make a temperature correction to the final result provided that the range of ± 5°C is not exceeded.

The correction is: $\dfrac{C_T}{1 + 0.026\,(T - 20)}$

where

$C_{20°} =$

C_T is conductivity at temperature T°C

NOTE: The conductivity of the potassium chloride standard solution (see F-4.3) is given for a temperature of 20°C. If the measurement cannot be made at the standard temperature of 20°C then the conductivity of the potassium chloride standard solution has to be determined by the formula;

Conductivity of KCI (see F-4.3) at T°C = 26.6 [1+0.021 (T- 20)] in the range 20°C ± 5°C.

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Annex G
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (vi)]

DETERMINATION OF SULPHUR DIOXIDE BY THE ROSANILINE CALORIMETRIC METHOD

G-1 Field of Application

This method is based on the calorimetric determination of sulphur dioxide and is applicable to plantation white sugar, refined sugar and sugar products.

G-2 Principle

The colour of a sulphite/rosaniline complex is measured photometrically, at a wavelength near to 560 nm, after reaction with formaldehyde.

G-3 Reagents

G-3.1 Rosaniline Hydrochloric Solution (Saturated)

Suspend 1 g of rosaniline hydrochloride in 100 ml of distilled water, heat to 50°C and cool with shaking. After standing for 48 h, filter the solution.

G-3.2 Decolourized Rosaniline Solution — Transfer 4 ml of saturated rosaniline hydrochloride solution to a 100 ml volumetric flask. After addition of concentrated hydrochloric acid (6 ml) make the mixture up to the mark. Decolourization takes places in short time but allows the solution to stand for at least 1 h before use.

G-3.3 Formaldehyde Solution (approximately 0.2 g/ 100 ml) — Dilute 5 ml of analytical reagent grade formaldehyde solution, p^{20} = 1.070 – 1.080 to 1 000 ml.

G-3.4 Pure Sucrose Solution — Dissolve 100 g of analytical reagent grade sulphite-free sucrose in water and make up to 1 000 ml.

G-3.5 Sodium Hydroxide Solution, 0.1 mol/l.

G-3.6 Iodine Solution, 0.05 mol/l - Dissolve 20 g of analytical reagent grade iodate-free potassium iodide in 40 ml of distilled water in a 100 0 ml volumetric flask. After the addition of 12.69 g of analytical reagent grade iodine shake the flask until all the iodine is dissolved and then make up to the mark with distilled water.

G-3.7 Concentrated Hydrochloric Acid, p^{20} = 1.18 g/ml.

G-3.8 Hydrochloric Acid Solution, approximately 1 mol/l.

G-3.9 Iodine (Starch) Indicator, ready-made, or a starch solution.

G-3.10 Sodium Thiosulphate Solution, 0.1 mol/l — Dissolve 24.817 g of analytical reagent grade sodium thiosulphate pentahydrate in 200 ml of distilled water in a 1 000 ml volumetric flask and then makeup to the mark.

G-3.11 Standard Sulphite Solution — Dissolve approximately 2.5 g of general purpose reagent grade sodium sulphite heptahydrate in sucrose solution (*see* G-3.4) and make up to 500 ml with this pure sucrose solution (*see* G-3.4). Determine the titre of this solution as follows. Place 25 ml of the 0.05 mol/l iodine solution in a 300 ml conical flask and add 10 ml of the 1 mol/l hydrochloric acid solution (*see* G-3.8) followed by approximately 100 ml of distilled water.

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Pipette 25 ml of standard sulphite solution into this flask while swirling the flask. Then titrate the excess iodine with the 0.1 mol/l sodium thiosulphate solution (*see* G-3.10) until the contents of the flask area pale straw colour. Then add the iodine (starch) indicator (*see* G-3.9) (0.2 g to 0.5 g) to the flask and continue the titration until the blue colour disappears. Record the titre, *t*.

G-3.12 Dilute Standard Sulphite Solution — Dilute 5 ml of standard sulphite solution (*see* G-3.11) to exactly 100 ml with pure sucrose solution (*see* G-3.4). The exact value of the sulphite content, *c* is calculated as follows from the titre, *t*, found in G-3.11:

$$c = (25 - t) \times 3.203 \times 2 \text{ mg } SO_2\text{/ml}$$

NOTE: Users of this method are advised to consult their national health and safety legislation and chemical suppliers before handling rosaniline hydrochloride, formaldehyde and the other reagents here mentioned.

G-4 Apparatus and Glassware

G-4.1 Spectrophotometer or Colorimeter, for use at approximately 560 nm.

G-4.2 Volumetric Flasks, 10 ml, 500 ml and 1 000 ml.

G-4.3 Graduated Pipette, 10 ml.

G-4.4 Pipettes, 2 ml,10 ml and 25 ml.

G-4.5 Burette, 10 ml, graduated by 0.05 ml.

G-4.6 Test Tubes

G-4.7 Analytical Balance - Capable of weighing to the nearest 0.1 mg.

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G-5 Procedure

G-5.1 Colour Development

Dissolve 10-40 g of a sample of white sugar in distilled water in a 100 ml volumetric flask. After addition of 0.1 mol/l sodium hydroxide solution (4 ml) make the contents of the flask up to the mark and mix: For levels

0-5 mg SO_2/kg use 40 g of sample

5-15 mg SO_2/kg use 20 g of sample

15-30 mg SO_2/kg use 10 g of sample

Transfer a 10 ml aliquot to a clean, dry test tube. Add 2 ml of decolourized rosaniline solution and 2 ml of formaldehyde solution and allow the tube to stand at room temperature for 30 min. Measure the absorbance in a 1 cm cell in a spectrophotometer (*see* G-4.1) at about 560 nm using distilled water as a reference.

G-5.2 Standard Curve

Pipette aliquots of the dilute standard sulphite solution (*see* G-3.12) (1 ml, 2 ml, 3 ml, 4 ml, 5 ml and 6 ml) into a series of 100 ml volumetric flasks. Take an empty flask as well for the zero sulphite level. To each flask add 4 ml of 0.1 mol/l sodium hydroxide and make the contents up to the mark with pure sucrose solution (*see* G-3.4) and mix. From each flask transfer a 10 ml aliquot to a clean, dry test tube. Add 2 ml of decolourized rosaniline solution and 2 ml of formaldehyde solution and allow the tubes to stand at room temperature for 30 minutes. Measure the absorbance as in G-5.1 and plot the results on a graph.



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$$\text{The amount of } SO_2 \text{ in each test tube} = \frac{c \times n}{10} \mu gSO_2$$

where

c is concentration of sulphite
n is the number of ml of dilute sulphite added to each 100 ml flask and *c* is from G-3.12.

G-6 Expression of Results

G-6.1 Calculation

Calculate the concentration of sulphite by reference to the standard curve and express the result as mg SO_2/kg white sugar as follows:

$$\frac{\mu gSO_2 \text{ from graph} \times 10}{\text{Mass of sugar used in G-5.1}} \text{ mg } SO_2 \text{ /kg sugar}$$

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Annex H
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (vii)]
(Alternate Method)
DETERMINATION OF LEAD BY COLORIMETRIC METHOD

H-1 Field of Application

The method is based upon a colorimetric procedure and is suitable for white and raw sugar, as well as low grade products with lead contents not exceeding 0.5 mg Pb/kg. A dry ashing step for raw sugar and wet ashing for low-grade products is first required to eliminate organic matter. However, this pre-treatment is not necessary for white sugar.

H-2 Principle

H-2.1 For White Sugar

Lead is extracted directly from the prepared solution by shaking with a solution of dithizone in chloroform and discarding the aqueous layer. Dithizone forms a distinctive red, chloroform-soluble complex with lead in solution. Complete extraction from the aqueous phase is possible when the pH is between 9 and 11.5. Interference from other ions is prevented by the addition of ammonium citrate and potassium cyanide. A final colour matching is carried out by adding a known amount of lead in solution to a dithizone blank.

H-2.2 For Raw Sugar

Organic constituents cause emulsification of the dithizone in chloroform, resulting in poor separation of the aqueous and chloroform phases. Removal of the organic constituents is achieved by ashing the sugar, after addition of magnesium nitrate at a temperature not exceeding 500°C.

H-2.3 For Low-Grade Products

A wet-ashing procedure is recommended, as dry ashing methods have not been found to be convenient for routine analysis. This procedure involves the use of a sulphuric/perchloric/nitric acid mixture and is particularly suited to liquid products. When calcium is known to be present a slightly modified two-acid procedure, based upon using nitric and perchloric acid, is preferred.

H-3 Reagents

Although traces of lead in the reagents are allowed for by carrying a blank through the entire procedure, it is desirable that solutions be prepared from analytical grade reagents or those specified as suitable for trace metal analysis.

H-3.1 Dithizone Solution, Approximately 0.1 g/100 ml — Prepare this stock solution by dissolving 0.1 g of diphenylthiocarbazone in 100 ml of analytical reagent grade chloroform.

H-3.2 Dithizone Solution, Approximately 20 mg/l — Prepare a fresh solution daily, or as required, by diluting 2 ml of the stock solution (*see* H-3.1) to 100 ml with analytical reagent grade chloroform. Store the solution in an amber bottle and in a cupboard away from the light.

H-3.3 Ammonia Solution, p_{20} ~ 0.88 g/ml.

H-3.4 Ammonium Citrate Solution — Dissolve 62.5 g of tri-ammonium citrate in 200 ml of lead-free water. Add 5 ml of the ammonia solution and dilute to 250 ml with distilled water at 20°C. Extract the solution with successive volumes of the 0.1 g/100 ml dithizone solution (*see* H-3.1**)** to ensure complete removal of heavy metals, a state indicated by the green colour persisting in the chloroform layer. Remove excess dithizone from

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the aqueous phase by successive extractions with small amounts of chloroform until the aqueous solution is colorless.

H-3.5 Potassium Cyanide — Dissolve 5 g of analytical reagent grade potassium cyanide in distilled water and dilute to 100 ml at 20°C. Allow to stand for 2 days before use, to allow for the oxidation of traces of sulphur.

H-3.6 Concentrated Nitric Acid, p_{20} = 1.42 g/ml.

H-3.7 Concentrated Hydrochloric Acid, p_{20} = 1.18/ml.

H-3.8 Concentrated Sulphuric Acid, p_{20} = 1.84/ ml.

H-3.9 Concentrated Perchloric Acid, p_{20} =1.54/ml.

H-3.10 Nitric Acid, Approximately 1 Percent (v/v) — Dilute 10 ml of concentrated nitric acid (*see* H-3.6) containing less than 0.005 mg Pb/kg to 1 litre with lead-free water at 20°C.

H-3.11 Nitric Acid, Approximately 1 mol/l — Dilute 15.6 ml of concentrated nitric acid (*see* H-3.6) to 250 ml with lead-free water.

H-3.12 Bromothymol Blue Indicator — Dissolve 0.04 g in 20 percent ethanol and make up to 100 ml with 20 percent ethanol.

H-3.13 Standard Lead Solution — Prepare a stock standard solution A by dissolving 0.160 g of previously dried analytical reagent grade lead nitrate in 100 ml of 1 mol/l nitric acid (*see* H-3.11). Solution B is freshly prepared by diluting 10 ml of the stock solution A to 1 litre with distilled water.

H-3.14 Hydroxylamine Hydrochloride Solution — Dissolve 20 g of analytical reagent grade hydroxylamine hydrochloride in 100 ml of distilled water.

H-3.15 Sodium Hexametaphosphate Solution — Dissolve 10 g in 100 ml of distilled water.

H-3.16 Magnesium Nitrate Solution — Dissolve 10 g in 100 ml of distilled water.

H-3.17 Chloroform, p_{20} = 1.49 g/ml.

NOTE: Users of this method are advised to consult their national health and safety legislation before handling potassium cyanide, lead nitrate, perchloric acid and other reagent a here listed. Users of the wet digestion method are also advised that indiscriminate use of perchloric acid can result in an explosion hazard. Carry out the wet digestion in a fume cupboard behind an arrnoured glass screen.

H-4 Apparatus and Glassware

Wash all apparatus, including separating funnels, microburettes, pipettes and new glassware in 10 percent sodium hydroxide, followed by dilute nitric acid and finally rinse in distilled water.

H-4.1 Pipettes — 5 ml and 10 ml, conforming to Class A.

H-4.2 Graduated Pipettes — 10 ml, conforming to Class A.

H-4.3 Volumetric Flasks — 100 ml and 1 000 ml**,** conforming to Class A.

H-4.4 Separating Funnels — 100 ml.

H-4.5 Microburettes — 2 ml and 5 ml (graduated 0.05 ml) and 25 ml.

H-4.6 Nessler Tube — 25 ml.

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H-4.7 Test Tubes — Pyrex glass, 200 mm × 24 mm, marked at 10 ml and 25 ml.

H-4.8 Platinum Dish

H-4.9 Muffle Furnace

H-4.10 Water Bath, boiling

H-4.11 Erlenmeyer Flasks — 100 ml.

H-4.12 Analytical Balance — Capable of weighing to the nearest 0.1 mg.

H-4.13 Electrical Hot-Plate

H-5 Procedure

H-5.1 White Sugar

a) Sample preparation — Dissolve a 10 g sample in 20 ml of distilled water contained in a beaker and transfer the solution to a 100 ml separating funnel, using only 5 ml for rinsing. Add 2.5 ml of concentrated hydrochloric acid, stopper the funnel and shake for 5 min. Prepare a blank by adding the same volume of hydrochloric acid (2.5 ml) to 25 ml of distilled water contained in another funnel.

b) Extraction of lead — Add 5 to 6 drops of the bromothymol blue indicator to the solution for extraction, and neutralize with ammonia solution (*see* H-3.3) added drop wise from a burette until a blue colour is obtained. Add an additional 1.5 ml of ammonia solution followed by 1.0 ml of ammonium citrate solution (*see* H-3.4) and 1.0 ml of potassium cyanide solution (*see* H-3.5). Where it is known that iron is present in significant concentrations 1.0 ml of hydroxylamine hydrochloride solution (*see* H-3.14) should be added before the cyanide. Stopper the separating funnel and mix the content and well by shaking. Add between 5 and10 ml of the 20 mg/l dithizone solution (*see* H-3.2) incrementally from a 10 ml burette and repeat the mixing. If necessary, add more dithizone solution and continue the extraction until the lower chloroform layer has changed from the brick red colour of lead dithizone to a green, blue or purple colour indicating the extraction of lead from the aqueous phase. Add an equal volume of dithizone solution to the blank and mix in the same manner.

Transfer the chloroform phase to a second clean separating funnel and add about 2 ml of 20 mg/l dithizone solution to the aqueous phase remaining in the original funnel. Shake and transfer the chloroform layer to the original chloroform extract in the second funnel and treat the combined chloroform extract with 10 ml of 1 percent (v/v) nitric acid (*see* H-3.10). Shake vigorously so that the lead is transferred to the aqueous phase as indicated by the restoration of a pure green colour in the chloroform phase. Add more dilute nitric acid if the green colour is not obtained. Discard the exhausted chloroform phase, taking care to avoid any loss of the nitric acid solution. Treat the blank similarly.

c) Determination of lead — Treat the nitric acid solutions from the sample and blank with 0.2 ml ammonium citrate solution, 5 drops of ammonia solution and 0.2 ml potassium cyanide solution. Mix the solutions and add enough 20 mg/l dithizone solution to the sample funnel to change the brick red colour with shaking, to green, blue or purple. Add an equal amount of dithizone to the blank funnel, followed by shaking.

Transfer the complete contents of the separating funnels to Nessler tubes. Slowly add the dilute standard lead solution B from a 2 ml microburette to the blank tube until, on shaking, the colour matches the colour of the solution in the sample tube. Note the volume of solution B needed for matching.

H-5.2 Raw Sugar

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a) Sample Preparation by dry ashing — Weigh 5 g of the sample in a clean platinum dish or silica crucible and treat with 10ml magnesium nitrate solution (*see* H-3.16). Evaporate to dryness and ash the residue in a muffle furnace set at a temperature not greater than 500°C. It is essential that the temperature does not

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exceed 500°C, as it is known that some lead compounds are volatilized above this temperature. When the ash has been completely decarbonized, remove the dish or crucible and allow to cool. Dissolve the ash in 1 ml of concentrated hydrochloric acid (*see* H-3.7) and dilute with lead-free water to 25 ml.

b) Determination of lead — Heat the solution on a water bath for 15 min and determine the lead by following the procedure described in H-5.1 (Extraction of lead and Determination of lead).

H-5.3 Low-grade Products, Liquids and Solids

a) Sample preparation by wet ashing (calcium absent) — Conduct all digestion operation in fume cupboard. Refer to the note under H-3. Transfer the sample, equivalent to not more than 2 g of dry matter, to one of the marked test tubes and add 1 ml of distilled water. Carefully add 1 ml of concentrated sulphuric acid (*see* H-3.8) and 3 ml perchloric acid (*see* H-3.9) together with 3 glass beads. If necessary, warm gently to initiate charring. Treat slowly with 2 to 3 ml concentrated nitric acid (H-3.6) added drop-wise from a burette. Heat gently to boiling and continue the digestion until die solution is clear and almost colourless. Carefully add a few more drops, dropwise until Charring ceases. Continue heating to drive off excess perchloric acid, leaving a final volume of between 1 ml and 2 ml.

b) Sample preparation (when calcium is present) — Carry out all digestion operations in a fume cupboard (*see* Note under H-3). Transfer the sample, equivalent to not more than 2 g of dry matter, to a 100 ml Erlenmeyer flask. Add 1 ml of distilled water, followed by 3 ml of nitric acid (*see* H-3.6) and 2 ml of perchloric acid (*see* H-3.9). Heat from cold on an electrical hot-plate, using a layer of asbestos sheet to moderate the heat. When the liquid turns brown, add more nitric acid drop-wise (not more than 3 ml) and warm until the white fumes of perchloric acid are given off. A colourless solution indicates completion of the digestion phase .

c) Determination of lead — Boil the solutions prepared under the above sections for about 30s to dissolve any solid material present. Add 6ml of ammonium citrate solution (*see* H-3.4) and 10ml of sodium hexa meta - phosphate solution (*see* H-3.15) If not clear, boil again. Dilute the solution to 25 ml with distilled water and quantitatively transfer the solution to a separating funnel for extraction using the procedure described under 15.5.1(a) and (c).

H-6 Expression of Results

H-6.1 White Sugar Calculation

The lead content is expressed as mg Pb/kg white sugar. Where the sample mass used is 10 g, then 1 ml of solution B is equivalent to 1 mg Pb/kg of white sugar. Where the sample mass differs from 10 g the lead content may be calculated as follows:

$$\frac{10\,V}{M} \text{ mg Pb/kg}$$

Where

V is volume, in ml, of the dilute standard lead solution used in matching, and
M is mass, in g, of the original sample.

H-6.2 Raw Sugar Calculation

Where the sample mass used is 5 g then 1ml of solution B is equivalent to 2 mg Pb/kg of raw sugar. Use the formula given in H-6.1 for other sample masses.

H-6.3 Low-Grade Products, Liquid and Solids Calculation

Where the sample mass used is 2 g then 1ml of solution B is equivalent to 5 mg Pb/kg of product, liquid or solid. Use the formula given in H-6.1 for other sample masses

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Annex I
(Normative)
[*Clause* 4.2, Table 1, Sl. No. (viii)]
DETERMINATION OF CHROMIUM CONTENT

I-1 Principle

Metals in solution are determined directly by atomic absorption spectrophotometry. Suspended metals are separated by membrane filtration or suspension is dissolved and analyzed.

I-2 Apparatus

I-2.1 Atomic Absorption Spectrophotometer

Spectrophotometer capable of operating at conditions as given under

Wavelength nm	Flame	Optimum Range mg/l
(1)	(2)	(3)
357.9	Reducing air — acetylene	1 to 200

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I-3 Reagents

I-3.1 De-ionized Distilled Water — Distilled, ammonia free. Pass through ion exchange column of mixed strongly acidic cation and strongly basic anion exchange resins. Regenerate resins according to mixed strongly acidic cation and strongly basic anion exchange resins.

I-3.2 Nitric Acid — Dilute 500 ml re-distilled nitric acid to 1 000 ml with water.

NOTE: Perform distillation in hood with protective ash in place.

I-3.3 Hydrochloric Acid — Dilute 500 ml hydrochloric acid to 1 000 ml with water and distill in all-Pyrex or equivalent glass apparatus.

I-3.4 Chromium Solution

I-3.4.1 Chromium stock solution — Accurately weigh amount of metal specified in Table 4 into a beaker and add dissolving medium. When metal is completely dissolved, transfer quantitatively into 1 000 ml volumetric flask and dilute to volume with water.

Table 4 - Preparation of Chromium Standard Solution
***(Clause* I-3.4.1)**

Weight	Compound	Dissolving Medium (1 litre Total)
(1)	(2)	(3)
1.923	Chromium oxide(Cr_2O_3)	Water + 10 ml redistilled nitric acid

I-3.4.2 Chromium Working Solution — Prepare daily. Dilute aliquots of stock solutions with water to make more than or equal to 4 standard solutions within the range of detection as given in I-2.1. Add 1.5 ml nitric acid

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per litre to all working standard solutions before diluting to volume. Add 1 ml lanthanum chloride for every 10 ml making the working standard solution.

I-3.5 Lanthanum Stock Solution — Slowly add 250 ml hydrochloric acid to 58.65 g lanthanum oxide (La_2O_3), purity 99.9 percent by mass, dissolve and dilute to 1 000 ml.

I-3.6 Ammonium Pyrrolidine Dithiocarbamate Solution — Dissolve 1 g ammonium pyrrolidine dithiocarbamate in 100 ml water. Prepare fresh daily.

I-4 Preparation of Sample

Take 5 g of sample and dissolve in distilled water and make up the volume to 100 ml with water in a 100 ml volumetric flask. Transfer an aliquot of well mixed sample to the beaker and add 3 ml nitric acid. Heat and evaporate to dryness (do not boil). Cool and add 3 ml nitric acid and heat until digestion is complete, generally indicated by light coloured residue. Add 2 ml hydrochloric acid (1:1, v/v) and heat gently to dissolve the residue. Wash the watch-glass and beaker with water and filter. Wash the filter and discard. Dilute the filtrate with water to such a concentration that it is within the range of the instrument.

I-5 Determination

Transfer an aliquot of the sample to a 250 ml beaker and dilute to 100 ml with water. Prepare blank and standard solution in the same manner. Adjust the pH of the sample and standard solutions to 2.5 with hydrochloric acid using a pH-meter. Transfer quantitatively to a 200 ml volumetric flask, add 2.5 ml of ammonium pyrrolidine dithiocarbamate solution and mix. Add 10 ml methyl iso-butyl ketone and shake vigorously for 1 min. Let the layers be separated and then add water until the ketone layer is in the neck of the flask. Centrifuge, if necessary. Aspirate the ketone layer and record readings of standards and samples against blank. The fuel-to-air ratio should be adjusted to as blue flame as possible since organic solvents add to fuel supply. Prepare the calibration curve from the average of each standard and read the sample concentration.

I-6 Calculation

Chromium content, mg/l = Chromium, in mg, in the aliquot/litre.

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Annex J
(Normative)
[*Clause* E-6.1]

DETERMINATION OF REFRACTOMETRIC DRY SUBSTANCE (RDS Percent)

J-1 Scope and Field of Application

The method is used in trading for the determination of the refractometric Brix or the refractometric dry substance (RDS percent) of sugar solution.

J-2 Principle

The refractive index of aqueous sugar solutions depends upon the amount of dissolved material and can therefore serve as a measure of the sugar content. This is valid only for pure sugar solutions; however, the non-sugars present in sugar products influence the refractive index in a similar way to sucrose. For these reasons, the measurement of refractive index can be utilized for an approximate determination of the dry substance content of solutions containing mainly sucrose.

Measurements are generally carried out with sugar refractometer graduated in percent sucrose (g/100 g); alternatively this result may be obtained from refractive index tables for pure sucrose solutions.

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J-3 Apparatus and Glassware

J-3.1 **Refractometer**, for example, Abbe type, calibrated at 20°C and having a water-jacketed prism.

J-3.2 **Light Source**, for example, tungsten lamp.

J-3.3 **Plastic Rod**, approximately 3 mm diameter.

NOTE: A plastic rod for example perspex or polypropylene, is preferred for this duty. When using a glass rod there is a possibility of inadvertently scratching the prism faces. Scratched prisms yield an indefinite boundary line and will eventually call for an expensive repolishing operation. Scratching may also occur during prism cleaning, therefore care should be exercised when removing molasses from the prism faces. When cleaning the prism faces, use cool water and soft tissues; do not use hot water for this purpose.

J-3.4 **Thermometer**, 150 mm, range 0°C - 50°C.

J-3.5 **Beaker**, capacity 50 ml.

J-3 6 **Water Bath and Pump**, Thermostatted generally at 20°C.

J-4 Procedure

J-4.1 Reading the Refractometer

Ensure that the instrument has been set up and checked according to the manufacturer's instructions and that the prism faces are clean and dry. The following apply to the Abbe type.

With the prisms closed, allow temperature controlled water (20°C) to flow through the prisms jacket for a period long enough for equilibrium to be reached; 5 min is usually sufficient.

NOTE: When operating at temperature other than 20°C refer Table 5 for corrections to be applied



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Table 5- Temperature Correction
[*Clause* J-4.1]

Temperature	Measured Sucrose (Mass Fraction)		
	45	50	55
(1)	(2)	(3)	(4)
15	− 0.38	− 0.38	− 0.38
16	− 0.30	− 0.31	− 0.31
17	− 0.23	− 0.23	− 0.23
18	− 0.15	− 0.15	− 0.15
19	− 0.08	− 0.08	− 0.08
20	0.00	0.00	0.00
21	+ 0.08	+ 0.08	+ 0.08
22	+ 0.16	+ 0.16	+ 0.16
23	+ 0.24	+ 0.24	+ 0.24
24	+ 0.32	+ 0.32	+ 0.32
25	+ 0.40	+ 0.40	+ 0.40
26	+ 0.48	+ 0.48	+ 0.48
27	+ 0.56	+ 0.56	+ 0.56
28	+ 0.65	+ 0.65	+ 0.64
29	+ 0.73	+ 0.73	+ 0.72
30	+ 0.82	+ 0.81	+ 0.80
31	+ 0.90	+ 0.90	+ 0.89
32	+ 0.99	+ 0.99	+ 0.98
33	+ 1.08	+ 1.07	+ 1.07
34	+ 1.16	+ 1.16	+ 1.15
35	+ 1.25	+ 1.25	+ 1.24
36	+ 1.34	+ 1.34	+ 1.33
37	+ 1.43	+ 1.43	+ 1.41
38	+ 1.53	+ 1.52	+ 1.50
39	+ 1.62	+ 1.61	+ 1.59
40	+ 1.71	+ 1.70	+ 1.68

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Transfer a drop of water to the refractometer prism to first determine whether a reading of zero is obtained or if a correction needs to be applied.

Transfer a small amount sugar solution from the container to the beaker and adjust the sugar solution temperature to approximately that of the instrument, 18°C - 28°C is suitable.

Open the refractometer prism and apply a drop of sugar solution to the fixed prism face by means of the plastic rod. Extend the sugar solution quickly as a line along the face without touching the prism surface with the rod, taking care to avoid the formation of air bubbles. Close the prisms quickly.

Take the refractometer reading according to the instrument manufacturer's handbook. Apply any scale correction to the reading to obtain a corrected reading.

J-5 Expression of Results

J-5.1 Express results to the nearest 0.1°Brix (0.1 percent RDS).

J-5.1.1 Calculation

Where the Refractometer is calibrated in refractive index, read the nearest 0.000 05 units and determine the °Brix (RDS percent) from Table 6.

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Table 6 - International Refractive Index Scale for Pure Sucrose Solution at 20°C [*Clause* J-5.1.1]

This Table gives values of refractive index against air with sucrose mass fraction.

Sucrose G/100 g	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
46	1.411 808	1.412 011	1.412 215	1.412 420	1.412 624	1.412 828	1.413 033	1.413 238	1.413 443	1.413 648
47	1.413 853	1.44 059	1.414 265	1.414 470	1.414 676	1.414 882	1.415 089	1.415 295	1.415 502	1.415 708
48	1,415 915	1.416 122	1.416 330	1.416 537	1.416 744	1.416 952	1.417 060	1.417 368	1.417 576	1.417 785
49	1.417 993	1.418 202	1.418 411	1.418 620	1.418 829	1.419 038	1.419 247	1.419 457	1.419 667	1.419 877
50	1.420 087	1.420 297	1.420 508	1.420 718	1.420 929	1.421 140	1.421 351	1.421 562	1.421 774	1.421 985
51	1.422 197	1.422 409	1.422 621	1.422 833	1.423 046	1.423 258	1.423 471	1.423 684	1.423 897	1.424 110
52	1.424 323	1.424 537	1.424 750	1.424 964	1.425 178	1.425 393	1.425 607	1.425 821	1.426 036	1.426 251
53	1.426 466	1.426 681	1.426 896	1.427 112	1.427 328	1.427 543	1.427 759	1.427 975	1.428 192	1.428 428
54	1.428 625	1.428 842	1.426 059	1.429 276	1.429 493	1.429 711	1.429 928	1.430 146	1.430 364	1.430 582
55	1.403 800	1.431 019	1.431 238	1.431 456	1.434 675	1.431 894	1.432 114	1.432 333	1.432 553	1.432 773

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PAKISTAN STANDARD SPECIFICATION FOR POLYPROPYLENE WOVEN SACKS FOR THE PACKING AND TRANSPORTATION OF FOOD ITEMS

0. FOREWORD

0.1 This Pakistan Standard was adopted by the Standards Development Centre, Pakistan Standards and Quality Control Authority (PSQCA) on 21st December, 2017, endorsement by National Standards Committee for (Textile). The draft having been finalized by the Technical Committee for Synthetic Textile (Bags & Cordages) TC-15.

0.2 This standard was first established in 1992 and then in 2008 and 2014; the committee felt it necessary to revise in the light of latest development in the industry.

0.3 In drawing up this standard the views of the consumers, manufacturers, traders, and the technologists have been taken into consideration by the Technical Committee, and the need for international co-ordination of standard enforced in different countries of the world for promotion and easy flow of international trade has been kept in view. The development of standard is a continuous process therefore, it is hoped to review this standard periodical on the basis of experience gained and studies made.

0.4 In order to keep abreast of the progress in industry the Pakistan Standards are subject to periodical review; suggestions for improvement shall always be welcomed and put up to the relevant committee for its consideration.

0.5 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, shall be rounded off in accordance with PS: 103 “Methods and rules for rounding off numerical values”.

1. SCOPE

1.1 This standard specified that general characteristics, requirements and methods of test for sacks made of tubular woven polypropylene un-laminated / laminated fabrics and having a filling mass from 10 to 80 kg, intended for packing and transportation of food items such as Sugar, Wheat, Rice, Wheat flour, Suji, Maida, Choker, Pulses, Salt, and Edible, etc.

Note: *To ensure food security by minimizing over 5% of dusting of wheat flour, it is mandatory to use one side (outer) laminated and one side woven polypropylene sack to reduce the dusting up to 0.05%. However, both side lamination is optional for Wheat Flour Sack as and if required. The use of one side laminated and one side woven sacks for sugar and wheat are optional.*

2. TESTING:

2.1 Testing of all samples shall be carried out in accordance with PS: ISO 139 i.e. temperature 27 ± 2^0C.

3. MANUFACTURE:

3.1 ***Tape:*** The polypropylene tapes used shall be made by virgin food grade granules (without addition of colour giving translucent look with addition of Calcium Carbonate up to 3.0 % maximum for sugar sacks only) and shall be polypropylene tape having minimum width of 2.5 mm (± 3 %). The linear density shall not be less as described in Table – I.

3.2 ***Fabric:*** The fabric used in the manufacture of Polypropylene woven sacks shall be produced from tapes (3.1), either in shape of tube on a circular loom. The constructional details found suitable are given Table – I. The cloth shall be evenly woven and generally free from rips, tears and mispick (loose weave).

3.2.1 ***Tubular Woven:*** The sack tube is produced, in a continuous length on circular loom. The weft is passed via the shuttle through each layer, in turn; in such a way that it forms a tube in which the weft is continuous and it lies in the transverse direction of the finished sack.

3.3 ***Sacks:*** The sack shall produce from fabric woven as a tube (3.2.1) and cut to the required length or converted from woven material (3.3) and stitched accordingly.

3.4 ***Seam:*** The stitching shall be done with single / double row of either lock stitch or chain stitch. The row stitching should be approximate 8 mm (min. 5 mm) from the outer edge of the sack. Stitching should be done with fold over seam to a depth of minimum 20 mm, so that the stitching passes through a minimum of four layers of the fabric. The number of stitches per decimeter shall be 16 - 20, the lock or chain stitch may be as recommended in PS: ISO 4915 “Types of stitches”.

3.4.1 The material used for stitching shall be nylon / polyester, polypropylene filament or any other thread suitable for the purpose, compatible to the product being packed in the sack. The stitching shall uniform without any loose thread of knot.

3.5 ***Mouth of the sack:*** The mouth of the sack should be hammed or heat / cold cut, so that the tapes do not fray.

3.6 ***Capacity:*** The sack shall have a nominal capacity of holding 10 to 80 kg for transport of food items.

TABLE – I
REQUIREMENTS OF TRANSLUCENT POLYPROPYLENE WOVEN SACKS FOR THE PACKING AND TRANSPORTATION OF FOOD ITEMS

Food items	Quality No.	Kg	Dimensions in mm (inch)		Mass/ sq. Meter (gm)	Mass per bag (gm)	Density/dm (inch) (Min)		Denier of Tape (Min)
			Outside length	Outside width			Ends	Picks	
SUGAR	1.	50	950 (37)	559 (22)	94	105	43(11)	43(11)	985
WHEAT	2.	50	991(39)	584(23)	94	115	43(11)	43(11)	985
WHEAT FLOUR	3.	80	1194(47)	686(27)	58	100	40(10)	40(10)	655
	4.	40	914(36)	559(22)	58	62	40(10)	40(10)	655
	5.	20	711(28)	457(18)	58	41	40(10)	40(10)	655
	6.	10	559(22)	381(15)	64	30	40(10)	40(10)	725
SUJI	7.	50	1016(40)	559(22)	82	98	40(10)	40(10)	920
MAIDA	8.	50	991(39)	610(24)	80	102	40(10)	40(10)	900
	9.	34	1092(43)	686(27)	58	92	40(10)	40(10)	655
CHOKER	10.	24	991(39)	635(15)	58	77	40(10)	40(10)	650
	11.	20	914(36)	559(22)	59	64	40(10)	40(10)	665
RICE/ PULSES/ SALT/ EDIBLES	12.	50	940(37)	584(23)	96	111	43(11)	43(11)	1000
	13.	50	940(37)	559(22)	89	99	40(10)	40(10)	1000
	14.	20	635(25)	457(18)	67	42	40(10)	40(10)	750
	15.	10	508(20)	381(15)	67	28	40(10)	40(10)	750
Tolerance			± 15mm	±10 mm	± 5%	± 5%	xxx		± **5%**
Method of Tests			PS: ISO 22198		PS: ISO 3801		PS: ISO 7211/2		PS: ISO 7211 – 5



TABLE – II
STRENGTH REQUIREMENTS OF TRANSLUCENT POLYPROPYLENE WOVEN SACKS FOR THE PACKING AND TRANSPORTATION OF FOOD ITEMS

Food items	Quality No.	Kg	Minimum Breaking Strength of fabric on 5x20 cm strip (kg)		Minimum Breaking strength of Seam (Kg)	Minimum Bursting Strength of base fabric (kg/cm^2)
			Warp	Weft		
SUGAR	1.	50	80	80	30	20
WHEAT	2.	50	80	80	30	20
WHEAT FLOUR	3.	80	50	50	30	15
	4.	40	50	50	30	15
	5.	20	50	50	30	15
	6.	10	50	50	30	15
SUJI	7.	50	75	75	30	20
MAIDA	8.	50	70	70	30	20
	9.	34	50	50	30	15
CHOKER	10.	24	50	50	30	15
	11.	20	50	50	30	15
RICE/ PULSES/ SALT/ EDIBLES	12.	50	85	85	30	20
	13.	50	85	85	30	20
	14.	20	60	60	30	15
	15.	10	60	60	30	15
Method of Tests			PS ISO: 13934/1		PS ISO: 13935 – 1	PS ISO: 13938 – 1

4 REQUIREMENTS:

4.4 ***Joint Bags:*** The sacks shall not be made from joint pieces. Any glue or adhesive not allowed for pasting.

4.5 ***Mass:*** The mass of the sack as given Table – I.

4.6 ***UV – Resistance Test:*** It is desirable by buyer and seller that the sacks are stabilized for U/V light. The procedure is described in Appendix – A.

4.7 ***Drop Test:*** It is desirable by buyer and seller that the drop test shall be carried out in accordance with PS: 4879 and the related parameter is prescribed in Appendix – B.

5 PRINTING, PACKING AND MARKING:

5.1 The sacks shall be marked with information as required by the buyer using suitable inks (Food Grade), and printing should be clear without any major smudging and missed portions. Inks should be non- fading water resistance.

Note: *The common practice of marking involves the use of silk screens or stencil for printing the matter when the number of sack ordered is small. When large numbers of sacks are required, the accepted method is flex-printing. The inks found suitable for printing are those based on polyamide resin. The shade of the inks should be uniform with normal machine tolerance*.

5.1.1 100 sacks will be tied to form a bundle and these bundles will be gathered so that 500 / 1000 sacks shall be packed to constitute a bale, which shall be formed by using a sheet of HDPE or PP woven fabric or any other suitable material and suitably secured.

5.2 The polypropylene woven un-laminated / laminated sacks may also be marked with Standard PS Mark.

Note: *The use of the Standard Mark is governed by the provision of the section XIII of PSQCA Act VI of 1996 and details of conditions, under which a License for the use of Standard Mark may be granted to manufacturers or processors, may be obtained from Director (Conformity Assessment) Standard Development Centre PSQCA Karachi.*

5.2.1 Each bale shall be marked with the following:

i) Name of the inside material,
ii) Net and gross weight of the material,
iii) Name of the mill, initials or trade mark,
iv) Date of manufacture/year,
v) Date of expiry,
vi) Any other information required by the buyer or by the law enforce,

6 SAMPLING AND CRITERIA FOR CONFORMITY:

6.1 ***Lot:*** In any consignment, all the sacks of the same construction shall be grouped together to constitute a lot.

6.2 The conformity of the lot to the requirements of the standard shall be determined on the basis of the test carried out on the samples selected from it.

6.3 The number of bales to be selected depends on the size of the lot and shall be in accordance with col. 1 and col. 2 of Table – III. The number of sacks to be selected from the bales sampled shall be in accordance with col. 3 of Table – III.

TABLE – III
SAMPLE SIZE AND CRITERIA FOR CONFORMITY

Number of sacks in Lot	Number of bales to be sampled	Sample size for visual, mass of sack inspection. Dimensions, Ends, and Picks.
(1)	**(2)**	**(3)**
Up to 25000	3	13
25001 to 40000	5	20
40001 to 50000	8	32
50001 and above	12	50

6.4 ***Criteria for Conformity:*** The lot shall be considered as conforming to the requirements of this standard if the following conditions are satisfied.

a) The number of defective sacks in case of visual inspection, ends, picks and dimensions is up to 10 percent of the sample size, subject to rounding off the fraction number to next higher integer.

b) Mass of none of sacks tested shall be less than 6 percent of specified mass. However, mass of 1000 sacks constituting a bale or multiples thereof shall not be less than -3 percent of specified mass of the bale.

APPENDIX – A.

A-1 ***UV- resistance test:*** The determination of the fluorescent of UV- radiation and weathering on the breaking strength of woven polypropylene fabric shall be carried out in accordance with ASTM G 53.

A-2 ***Test procedure:*** The test shall be carried out with fluorescent UV –Lamp type – B. The duration of the test shall be 144 hours (i.e. 6 days). The test cycle shall be 8 hours at +60 ^{0}C with UV – radiation, alternating with 4 hours +50 ^{0}C with consideration.

A-3 Criteria for passing the UV-resistance test. After the test, the breaking strength of the tested material shall be at least 50% of the original breaking strength.

APPENDIX – B.

B-1. ***Drop test:*** The drop test shall be carried out on three sacks and shall comprise of following sequence.

a) Flat dropping:

B-2 Flat dropping: The sack shall be dropped from a height of 1800 mm twice on one flat face and twice on the opposite flat face.

B-3 Carried for passing the drop test: After each drop there shall be no rupture or less of contacts. A slight discharge e.g. from closures, upon impact shall not be considered a failure of the sack provided that no further leakage occurs after the sack has been raised clear of the ground.

R E F E R E N C E S

1	PS: 103	Method and rules for rounded off numerical value.
2	PS: 4879	Cotton, jute and polypropylene woven sacks-Method of Drop test.
3	PS ISO: 139	Standard atmospheres for conditioning and testing.
4	PS ISO: 3801	Determination of mass per unit length and mass per unit area.
5	PS ISO: 4915	Stitch type-Classification & terminology.
6	PS ISO: 7211 – 2	Determination of number of thread per unit length.
7	PS ISO: 7211 – 5	Determination of linear density of yarn removed from fabric.
8	PS ISO: 13934 – 1	Tensile properties of fabrics-Determination of maximum force elongation at maximum force using the strip method.
9	PS ISO: 13935 – 1	Seam Tensile properties of fabric and made-up textile article- Determination of maximum force to seam rupture using the strip method.
10	PS ISO: 13938 – 1	Bursting strength of fabrics-Hydraulic method for determination of bursting strength bursting distension.
11	PS ISO: 22198	Textile-fabric-Determination of width & length.