

DL MILLAR AND COMPANY LIMITED Established since 1929

COMPLETE WATERPROOFING TURNKEY SOLUTIONS













DL MILLAR AND COMPANY LIMITED

Established since 1929, we are pleased to introduce ourselves as a reputed manufacturer for various infrastructure projects and have been serving various Govt Departments and private projects to meet their requirements for a variety of works. Under our brand name Dr. Millars, we are supplying PVC Geo –membranes, High Voltage Insulating mats, Promatt & PPE Kits & Coveralls. Dr. Millars PVC Geo –membranes are used for Tunnel Waterproofing. These PVC sheets are normally of 1.5 MM & 2.00 MM, produced in India as per a special formulation provided by our technical experts which meet the latest RVNL, IRCON, NHAI & are also as per BIS (IS:15909:2020) specifications.

The Geomembrane is produced by modern calendaring lines along with a well equipped laboratory meeting at the testing requirements of BIS, RDSO and RITES etc. which are international standards. The special features of PVC Geomembrane are that it confirms to uneven ground surface. enhancing life & can be easily repaired. This is most suitable product for tunnels as the PVC membranes have excellent flexi -bility & elongation which will not fail in case of earthquakes. The PVC Geomembrane installed by us meet all standard quality parameters and can be a safe economical option for water proofing applications.

Dr.Millars" brand PVC Geomembrane used for water proofing/ seepage control of concrete structures, Building roofs, foundations, Basements, tunnels, underpasses and sealing of expansion joints and for lining of reservoirs, water bodies, canals etc. for seepage control.

We Provide turnkey based projects i.e. Supply & Installation of PVC Geomembrane. We have complete range of Water Proofing Product.

About Dr. Millars Waterproofing membranes:

"Dr.Millars" PVC Geomembrane is 100% Indian under Make in India program meets the specification as per international standards (ASTM & EN) as well as IS: 15909:2010 (BIS specification for PVC Geomembrane lining).





SALIENT FEATURES

- Products are 100% made in India under the prestigious "Make in India" program which replaces 100% imported products & dependency on foreign companies.
- Possibility to produce & supply PVC membranes for tailor made specifications of large infra projects.
- Quick & on time delivery as goods are produced by a reputed PVC processing factory located near New Delhi under the supervision of Dr. Millar's engineers.
- Geo Textiles for tailor made requirement is got produced from OEM manufacturers & all installation accessories is sourced from reputed & approved suppliers along with test certificates.
- Test reports from reputed labs like M/s. Spectro Labs conforming to all properties meeting international ASTM & DIN Standards.



AREAS OF APPLICATION

Use of PVC Geomembrane for these applications is an accepted standard worldwide. The special features of PVC Geomembrane are that it confirms to uneven ground surface enhancing life & can be easily repaired

This is most suitable product for tunnels as the PVC membranes have excellent flexibility & elongation which will not fail even in case of mild earthquakes. The PVC Geomembrane supplied by us meet to all standard quality parameters and can be a safe and economical option for water proofing applications.

Water Proofing of Building Roofs and Foundations, Underground Concrete Structures like Basement Foundations etc.

Waste Containment for Industrial Effluents & Solid Waste Management to prevent contamination of Ground Water Aquifer.

Landfill Capping to prevent fluid flow into the land fill and to trap and properly vent the gases.

Lining of Canals for Imigation/Agricultural Purpose and many more.

Lining of Lakes/Reservoirs/Water Bodies for 100% Seepage Control including aquaculture reservoirs for Fish Farming.





Use of PVC Geomembrane for these applications is an accepted standard worldwide.

The PVC Geomembrane supplied by us meet to all standard quality parameters and can be a safe and economical option for water proofing applications







WHY GEOMEMBRANE IS RECOMMENDED ?

D.L.Millars & Company Ltd. Supplier a complete range of PVC Geomerobranes inresporce to a wide variety' of applications. Experience has shown that PVC-Geomembrane is most suitable for waterproffing of tunnels due to its excellent mechanical properties and its durability in accordance with the expected lifetime of the : applicable area.

In addition, this geomembrane can be laminated with a geotextile of polypropylene (up to 700 g/m^*) for bonded applications.

The waterproofing system with PVC-Geomembrane, Dr. Millars offers maximum securite against differential settlements, and risk of perfora – tion due to concrete reinforcement.

In addition, in the event of any damage occurred to the geomembrane, it offers the possibility to achieve a system to repair any leaking, with no perforation of the concrete shell.



DR MILLARS" PVC GEOMEMBRANE INSTALLATION PHOTOGRAPHS



RVNL PROJECT Berkhera-Budhni section of Bhopal Itarsi 3rd Line



Bhanupali-Bilaspur-Beri New Rail-line, Punjab/H.P.



KONKAN RAILWAY PROJECT



KONKAN RAILWAY PROJECT

Katra-Banihal section of Udhampur-Sri Nagar- Baramulla Rail-line T-5, Reasi Jammu Through Max Infa Limited



RVNL PROJECT Berkhera–Budhni section of Bhopal Itarsi 3rd Line T–5 Through Max Infra Limited

Katra-Banihal section of Udhampur-Sri Nagar- Baramulla Rail-line, T-13 Through Vensar Construction Company Limited



RVNL PROJECT Berkhera-Budhni section of Bhopal Itarsi 3rd Line Through Max Infra Limited

COMPARATIVE SPECIFICATIONS OF "DR MILLARS" 2.0 MM PVC GEOMEMBRANE

1 Thickness mm EN 186-2 2.0,10% 2.20 2.0,10% 2 Specific Weight Kg/m2 EN 180-2 En 12 2.5 2.5.5 3 Tensile Strength Mmm2 EN 160 527-3 15.2 2.51 1.5.7 4 Tensile Strength Mmm2 EN 160 527-3 15.2 2.50 1.5.20 1.5.20 4 Tensile Strength Mmm2 EN 160 527-3 1.250,-10% 1.5.200 1.5.200 4 Tensile Strength \mathcal{M}_{10} EN 160 527-3 1.250,-10% 1.5.200 1.5.200 5 Tensile strength \mathcal{M}_{10} EN 150 527-3 1.250,-10% 1.5.200 1.5.200 6 Tensile strength \mathcal{M}_{10} EN 1231-2 2.4.20 1.5.200 1.5.200 7 Tens Strength \mathcal{M}_{10} EN 100 107-2 2.40 2.80 1.5.200 6 Teor propogation strength N Oli N10726 2.100 2.100 2.100 2.100 1.5.00	SI. No.	Properties	Unit	Test Method	DLM1	DLM2	DLM3
2Specific WeightKg/m2EN 189-2Image: Specific WeightKg/m2EN 180 527-315 ±2		Thickness	mm	EN 1849-2	2.0, ±10%	≥2.0	2.0, -0/+10%
133 152 215 215 215 33 152 215 112 11	2	Specific Weight	Kg/m2	EN 1849-2			2.6±5%
3 Tensile Strength N/mm2 EN 12311-2 EN 12311-2 L 220, -10%, T 2250, -10%, T 22500, -10\%, T 2250, -10\%, T 2250, -10\%, T 2250, -10\%, T				EN ISO 527-3	15 ±2	≥15	
A Elengation of follore M Elliss 527-3 L250,-10% T250,-10% L:280 5 EN ISO 527-3 EN ISO 527-3 EN ISO 527-3 L250,-10% T:280 5 Teer Strength M EN ISO 527-3 240 Immediate in the strength Immediate in the strength EN ISO 527-3 240 Immediate in the strength Immediate in the strength 240 Immediate in the strength Immediate in the strength Immediate in the strength 240 Immediate in the strength Immediate in the strength Immediate in the strength 240 Immediate in the strength Immedi	3	Tensile Strength	N/mm2	EN 12311-2			L: ≥17 T: ≥17
$\begin{array}{c c c c c } & \begin{array}{c c c c } & \begin{array}{c c c c } & \begin{array}{c c c c } & \end{array} & $	4	Flopantion at failure	%	EN ISO 527-3	L:250, -10% T:250, -10%	L: ≥280 T: ≥280	
Here Strength KN/m EN ISO 34 240 End iso 34 240 6 Teor Strength N DIN 53363 280 280 2100			70	EN 12311-2			L: ≥300 T: ≥300
Marken Marken DIN 53363 280 6 Tear propagation strength N EN 12310-2 2100 2100 7 Behavior during perforation test Height of fall without perforation mm DIN 16726 2 1100 2 1100 No perforation of 111 height of fall 8 Cold folding resistance °C EN 495-5 No cracks at - 20°C So cracks at - 20°C So cracks at - 20°C No cracks at - 20°C So cracks at - 20°C So cracks at - 20°C So crac	5	Tear Strenath	KN/m	EN ISO 34	≥40		
6 Tear propagation strength N EN 12310-2 Len 1240 12100 12100 7 Behavior during perforation test Height of fall without perforation mm DIN 16726 2100 2100 2100 No perforation at 11 height of fall 8 Cold folding resistance °C EN 495-5 No cracks at - 20°C So cracks at - 20°C <th>J</th> <th>rou onongni</th> <th></th> <th>DIN 53363</th> <th></th> <th>≥80</th> <th></th>	J	rou onongni		DIN 53363		≥80	
7Behavior during perforation test Height of fall without perforationmmDIN 167262 11002 1100No perforation at 11 height of fall8Cold folding resistance°CEN 495-5No cracks at -20°CNo cracks at -30°C9Hydrostatic pressure resistanceEN 1928-BEN 1928-BEN 1928-BSaleSaleSaleSale10Dimensional Stability after accelerated ageing (6h/800C)%EN 150 1107-2SaleSaleSaleSale11Change of dimensioning after heating at 70 0C for 2 hours%EN 1110ResistantResistantResistantResistant12Root resistanceCodi and alkaline at 28 daysDIN 16726DIN 16726Image: EN 12317-2Root resistanceRoot resistance213.514Resistance of welded seam shearN/mm2EN 12317-2Root resistanceRoot resistance213.5	6	Tear propagation strength	Ν	EN 12310-2			≥100
8 Cold folding resistance °C EN 495-5 No cracks at - 20°C	7	Behavior during perforation test Height of fall without perforation	mm	DIN 16726	≥ 1100	≥ 1100	No perforation at 1100 mm height of fall
9 Hydrostatic pressure resistance EN 1928-B Waterproof at 5 bar hours 10 Dimensional Stability after accelerated ageing (6h/800C) % EN 150 1107-2 ≤2% ≤2% ≤2% ≤2% 11 Change of dimensioning after heating at 70 0C for 2 hours % EN 110 ≤2% ≤2% Stable 12 Root resistance EN 14416 Resistant Resistant Resistant 13 Resistance fo acid and alkaline at 28 days DIN 16726 IN 12317-2 Root resistance 20 % maximule longation	8	Cold folding resistance	C°	EN 495-5	No cracks at – 20°C	No cracks at – 20°C	No cracks at –35°C
10Dimensional Stability after accelerated ageing (6h/800C)%EN ISO 1107-2<2%	9	Hydrostatic pressure resistance		EN 1928-B			Waterproof at 5 bar for 24 hours
Indext 1 Change of dimensioning after heating at 70 0C for 2 hours EN 1110 Stable 12 Root resistance EN 14416 Resistant Resistant 13 Resistance to acid and alkaline at 28 days DIN 16726 20 % maximum elongation 14 Resistance of welded seam shear N/mm2 EN 12317-2 Root resistance Root resistance ≥13.5	10	Dimensional Stability after accelerated ageing (6h/800C)	%	EN ISO 1107-2	≤2%	≤2%	≤2%
12 Root resistance EN 1416 Resistant Resistant Resistant 13 Resistance to acid and alkaline at 28 days DIN 16726 20 % maximu elongation 14 Resistance of welded seam shear N/mm2 EN 12317-2 Root resistance Root resistance	11	Change of dimensioning after heating at 70 OC for 2 hours		EN 1110			Stable
13 Resistance to acid and alkaline at 28 days DIN 16726 20 % maximu elongation 14 Resistance of welded seam shear N/mm2 EN 12317-2 Root resistance Root resistance	12	Root resistance		EN 14416	Resistant	Resistant	Resistant
Resistance of welded seam shear N/mm2 EN 12317-2 Root resistance Root resistance ≥13.5	13	Resistance to acid and alkaline at 28 days		DIN 16726			20 % maximum elongation
resistance Break out of the j	14	Resistance of welded seam shear resistance	N/mm2	EN 12317-2	Root resistance	Root resistance	≥13.5 Break out of the joint
15 Resistant to static puncturing (24h/20kg) Kg EN 12730-B Root resistance Root resistance ≥ 20	15	Resistant to static puncturing (24h/20kg)	Kg	EN 12730-B	Root resistance	Root resistance	≥ 20
16 Behaviour in fire B2 ON B 3800/1 B2 SIA 280 IV.2 Root resistance DIN 4102 B2 EN ISO 11925 Class E	16	Behaviour in fire		B2 ON B 3800/1 SIA 280 DIN 4102 EN ISO 11925	B2 IV.2 B2 Class E	Root resistance	Class E

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ADVANTAGES OF PVC GEOMEMBRANE

There are distinct advantages that set PVC apart from the REST.....

PVC is the only material that can be engineered to adapt and perform according to Usage and Environments of extreme nature i.e. from the tropics to the desert and to the mountains.

In case of breach, the system can be repaired very fast by unskilled workmen without special equipments etc.

PVC remains elastic through its elongation. The minimum elongation at break for 0.76 mm is 380% for this reason PVC conforms to subgrade soil better.

30 mil PVC Geomembrane is equivalent to 60 mil HDPE Geomembrane. While the thickness of PVC Geomembrane is half that of HDPE Geomembrane the tensile strength is only 18% less than the HDPE Geomembrane.

PVC Geomembrane is amorphous material & is not subject to environmental stress cracking, whereas HDPE Geomembranes are cyrstalline structure in Nature. Stress cracking of a car windshield. A minuscule stone chip can create a shattring effect.

High Flexibility & Elongation till the balance in favour of PVC.

PVC has excellent chemical resistance to most of the chemicals, acids & alkalies



INTRODUCTION ABOUT BIS 15909:2020

- Bureau of Indian Standard brought out standard IS 15909 in 2010 for PVC Geomembrane for use as a lining material with a max thickness upto 1.5 mm.
- This specifications were revised in the year 2015 (first revision) by adding specifications of 2.0 mm thickness.
- In the year 2020 it was further revised (second revision), by incorporating Category–A & Category–B. For both categories they advised light coloured membranes to avoid using recycled PVC into the product.
- Category A for thickness up to 1.5 mm, for use in canals, ponds, reservoirs for seepage control, for lining of landfills, hazardous waste management, solid waste management and industrial effluent for waste containments and for water proofing of basement, roof/terrace.
- Category B for thickness 2.0 mm, 2.5 mm & 3.0 mm, PVC Geomembrane for unexposed application for use in large underground civil structures, basement, road underpasses, waterproofing of rail/road tunnels, bunkers, dams and other mega civil structures.
- Until recently PVC Geomembranes were being imported into India for waterproofing of Rail & Road tunnels, basements, bunkers, Naval & Defence projects, Metro Rail ducts etc.
- The European specifications suggested use of black layer membrane with a color signal layer on the top. Membranes with black color base can easily be produced using recycled material which help reduce costs but since product performance is desired for 50–100 years, quality can not be compromised.
- BIS has prepared the specifications accordingly by plugging all loop holes as the new standards ensures use of only virgin raw material by avoiding use of black and dark colors. BIS has also enhanced the specifications for better quality and longer life as per Indian conditions.





PVC GEOMEMBRANE AS PER BIS SPECIFICATIONS IS15909:2020 CATEGORY-B

SALIENT FEATURES OF BIS SPECIFICATIONS (1/7)



AS PER INTERNATIONA SPECIFICATION

AS PER BIS SPECIFICATIONS IS : 15909:2020 CATEGORY B



International Specification	BIS Specifications IS : 15909:2020 Category B	Advantages of BIS specs over International specs
Geomembrane for tunnels and basement works with signal layer (twin colours)-yellow/Black.	Shall be made from virgin raw material –twin colour with white signal layer, The bottom layer of the membrane shall preferably be in light orange colour. Any dark colour like black, blue, grey and brown etc. shall not be used for manufacturing of bottom layer so as to avoid use of recycled material.	Since BIS specs ensure use of virgin grade raw materials only, it will ensure consistency in quality in the entire batch. Use of recycled materials lead to a non homogeneous formulation leading to quality variation thereby increasing chances of failure over long periods of time.

SALIENT FEATURES OF BIS SPECIFICATIONS (2/7)

International Specification	BIS Specifications IS : 15909:2020 Category B	Advantages of BIS specs over International specs
Nil But actual thickness of signal layer is approx 0.8 mm	≤ 0.20 mm	During installation or during the welding of joints, membranes can get damaged due puncturing by sharp objects or due to burning during welding of joints. If signal layer is thicker, as is presently in the case of low quality products, even if the membrane has got damaged, it will not be visible which is a very important parameter. BIS has enhanced the specification by determining the thickness of the Signal Layer to a max of 0.20mm.

SALIENT FEATURES OF BIS SPECIFICATIONS (3/7)



SPECIFIC GRAVITY

International Specification	BIS Specifications IS : 15909:2020 Category B	Advantages of BIS specs over International specs
NIL	1.30 ± 0.03	Specific gravity has been mentioned for improved compliance. Lower specific gravity is a better-quality membrane

SALIENT FEATURES OF BIS SPECIFICATIONS (4/7)

ELONGATION PROPERTY



PROPERTIES	UNIT	BIS Specifications IS : 15909:2020 Category B	Advantages of BIS specs over International specs
Elongation at failure M T	%	≥ 300 ≥ 300	Elongation Property of IS Specification is improved. This will ensure better resistance against punctures.

SALIENT FEATURES OF BIS SPECIFICATIONS (5/7)



AS PER INTERNATIONAL SPECIFICATION

AS PER BIS SPECIFICATIONS IS : 15909:2020 CATEGORY B



PROPERTIES	International	BIS Specifications IS :	Advantages of BIS specs over
	Specification	15909:2020 Category B	International specs
Behavior after storage in aqueous	20% maximum	Change in tensile and	Ageing property of IS specification is
solution, resistance to acid and	variation in	elongation shall be within ± 10%	improved. It indicates better
alkali after 28 days	elongation	of the original value	durability/life.

SALIENT FEATURES OF BIS SPECIFICATIONS (6/7)



AS PER INTERNATIONAL SPECIFICATION





AS PER BIS SPECIFICATIONS IS : 15909:2020 CATEGORY B

PROPERTIES	International	BIS Specifications IS :	Advantages of BIS specs over
	Specification	15909:2020 Category B	International specs
Strength of welded seam shear resistance	≥13.5 N/mm2 break out of the joint	≥ 1050 N/50 mm	Specifications have been improved for better performance of welded joints.

SALIENT FEATURES OF BIS SPECIFICATIONS (7/7)



VERTICAL RATE OF BURNING

HORIZONTAL RATE OF BURNING



PROPERTIES	International Specification	BIS Specifications IS : 15909:2020 Category B	Advantages of BIS specs over International specs
Fire reaction	Class E	-	
Flammability Test, Horizontal & Vertical rate of Burning	-	≤ 100 mm/min	Flammability test as per tests facility available in India has been adopted.

INSTALLATION PROCEDURE TO INSTALL MEMBRANES IN TUNNELS

1. SURFACE PREPARATION

- The surface is cleaned with removing all the construction materials.
- Surface is made free from debris, dirt, standing water etc.
- Surface should be free from any potholes or depressions.
- Surface should have minimal undulations; undulations should be eliminated that are greater than B- 305 mm deep within any L-1525 mm linear distance

2. GEOTEXTILE FIXING

Geotextile/Dimple board is fixed on the clean surface by nailing the pvc roundles

3. FIXING OF PVC WATERPROOFING MEMBRANE

PVC waterproofing membrane is welded to the pvc roundles by fusion

- For the seam welding between two waterproofing membranes, Hot Air welding / Double wedge welding is used with an overlap of approx. 100 mm.
- The same system is followed for the Protection membrane.
- To compartmentalize the system, water bars are welded on the WP membrane.
- Welding should be done by TUV SUD certified welder with reference to the DVS codes.









4. Sample Assembly with protection membrane

APPROVAL LETTER RECEIVED FROM VARIOUS PROJECTS

कोकण रेलवे कॉपरिशन लिसिटेड	
R Kashan Dailway Compartian Limited	* Segmental Consulting & Infrastructure Advisory (P) Ltd
(31077 317317 30 376397) (A Government of India Undertaking)	SOWIL Limited Office September Consulting & Infectivities Advisory (7) IoS. JOK Bunglew, PD - Wein, Talvais-Way, Doeso, Sarara,
www.Leokasrailway.com No. KRIDD/ULK/4/20.04TEL (0//7/monel T0/07 Date: 24.02.2020	E-Mail: SOADAK KAIphigmentalia Project: CONSULTANCY SERVICES FOR AUTHORITY'S ENGINEER FOR SUPERVISION OF CONSTRUCTION OF NEW TWIN
Mis ACE Date (UN)	TUBE 6-UNIT TUNES AT EXAMINATE GRAT SECTOR OF 0H-4 AND ITS APPROACHES FROM DUSTING KM. 771-730 TO DUSTING KM. 782-000 IN THE STATE OF MAHAADSHTA UNDER INIOP PHASE-V ON EPC MODE.
USBRL TUNNEL - T2 PROJECT, Nr. Prasad Thr. To 1 Vilage & P.O. Bhaga, Tehail-Reasi	SCIA-SOWIL/GAYATRI - CRESCENT (JV)/2022/7/21 Date: 09/02/2022
District – Reasi (J&K) 182311	To, The Project Manager.
(Kind Attn: Shakeel Chauhan, Project Manager)	Gayatri-Crescent (JV) GE2. Indranast Building
Sub: Construction of Tunnel T-2 (between Km 33.212 to Km 38.375 approx.) on Katra-	Balaji Nagar, Near Spandan Hospital, Khandala-412802
Banihal Section of Udhampur-Srinagar-Baramulia New BG Railway Line Project (Package T-2)	(Kind Attention: Mr. Arvind Kulkarni - Project Manager)
 Approval of Vendors. 	Subject: Credentials of D.L. MILLARS & COMPANY Ltd - Manufacturer for Water Proofing
Ref: (1) C.A. No. IRCONU&K CELLUAT/14/1014/K-B/T-2/327/1017 dtd 14.05.2016. (2) KRCL Letter No. KR/PDIJ&K/AGE-PATEL (JV)/Tunnel T2/47 dtd 21.02.2019	Ref: 1, GAYATRI - CRESCENT (JV): PIU: Khambatki/2021-22/660. Dated: 02/02/2022
(3) KRCL Letter No. KR/PDJJKK/AGE-PATEL (JV)/Turnel 12/85 dtd 01.06.2019 (4) KRCL Letter No. KR/PDJJKK/AGE-PATEL (JV)/Turnel 12/85 dtd 01.06.2019 (4) KRCL Letter No. KR/PDJJKK/AGE-PATEL (JV)/Turnel 12/85 dtd 01.06.2019	Dear Sir,
(6) KRCL Letter No. KR/PD/J6K/AGE-PATEL (JV)/Turnel T2/02 dtd 12.12.2019	With reference to subject mentioned above & reference no. (1), EPC contractor has
M/s APJV had submitted the vendors profile tabulated below for approval of KRCL. The details of construction materials are tabulated as under:	Summitted the Credentials of D.L. MILLARS & COMPANY Ltd - Manufacturer of Water Proofing Membrane to be used in Tunnel has been reviewed by Authority Engineers & found
The second secon	in order, hence accorded for Provisional Approval.
S.no Material Description Source Premarks Hydrophilic Water stopper seal Maruf Techno rubber Destudie Vol 2644 Maruf Techno Rubber	 be arranged in the representation of AE to ascertain available facilities for quality testing Water Device the representation of AE to ascertain available facilities for quality testing
2 Geodese Pop Com Performent Reside 3 Water Proping Membrane – 2mm MYK Amment 4 Water Proping Membrane – 2mm DYK Milers	specification of sampling for third party testing at NABL certified laboratory & final approval devil
6 S0A – 32mm Dia Sup Anchor 6 Swelex Rock Bolt – 32mm Dia Argentium	Place note that material shall be accorded for the standard shall be accorded and the standard shall be accorded to the standard shall be accorded as a standard shall be standard shall be standard shall be accorded as a st
7 Steel Fiber Stewols 8 River Sand Karthan - Reasi	the third party test results conducted at NABL certified laboratory.
Geotextile 700 GSM Manas Geotextile Veter Proofing Membrane – 2mm Gayeth Gayeth	This is for information & necessary action.
The samples of the material were sent to approved laboratory for third party testing vide ref	For Segmental Lonsuiting & Infrastructure Advisory Pvt. Ltd.
(2) to (6) above. Based on the test reports received nom testing taboratory, which are found satisfactory in all parameters, the approval is hereby accorded for vendors for supply of	1 20 200
corresponding construction materials as mentioned above.	Ala Carrieren 2
Please note that this approval has been accorded on the condition of maintaining of quality	Rajesh Kumar
of product intact. In case of any negative feedback and deemonation in quality, this approval will stand cancelled automatically. Mandatory checks for ensuring the quality will also be 0	Cc.
Beller (Essenil) generalizionianenitera ganta, tibilite epener itere (Corporale Monitor) USERELIMELINGCOLLEUM Philips teri suor direc (2d 7 Induscrine) & Pairo (Pairo), "4985-9662 (Sc) 24-02	1. The Project Director, NHAJ, PIU Pune-for information. 2. Project Coordinator Segmental Consulting & Infrastructure Advisory Byt. Ltd. for
Subger andrew ; Berry ann, direc (1), eff. B. d. Korge, eff. (pd 4203)4 Royal Thelene Therma, Baster (1), CED Bellyon, Nucl Mondol: 600104, Tat 95 22 (2717)215-18, Fax: 823-27170409	Information.
YOKSEL	AECOM Industrial ACCOM Indust PALLS, B1 124 433 5100 MI B7, Minhy Tame C, B1 124 433 5100 Mi
No.: YPH -1857-PMC-GON-2205 09 July 2022	AECOM Indu PALK, B1 124 433 5100 MI Dominist BF, Mohy Tame C, DJ Cylor Cy, Pana A, Old Cylor Cy, Pana A, Old Cylor Cy, Pana A, Old Cylor Cy, Pana A,
No.: YPH -1857-PMC-GDN-2205 Te, Mr. Yashpal Singh Rathore, Project Manager	AECOM Intel PALSE, B1 124 433 5100 MI B7, Intel Y Start C, B1 124 433 5100 MI D24 CQM CQL Palae A, CQL CQM CQL Palae A, CQL CQL FOR THE MILE COLL VICE FOR THE COLL PALAE COLL VICE FOR THE COLL PALAE COLL VICE FOR THE COLL PALAE COLL VICE FOR THE COLL PALAE
No.: YPH -1857-PMC-GDN-2205 Te. Mr. Yashpal Singh Rathore, Project Manager Mr. Yashyuga Engineering Company Ltd., RVN. Camp. Packager S- Village & Pour: Maletha,	AECOM INSPIRE BY UNDY TWO CONTROL DUP CARE OF THE PALE. DUP CARE
No.: YPH -1857-PMC-GDN-2205 Te. Mr.: Yashpal Singh Rathore, Project Manager Mr. Nazyuga Engineering Company Ltd., RVNK Camp. Peckepes - Sillage & Pour: Maletha, Dist: Tehri Garbwal, Uttarakhand - 249161	AECOM MUSICINE BY Motor To By
No.: YPH -1857-PMC-GDN-2205 09 July 2022 Te, Mr. Yashpal Singh Rathore, Project Manager M/s Nazyuga Engineering Company Ltd, RVNK Camp, Packager S Village & Pour: Maletha, Dist: Tehri Garbwal, Uttarakhand - 249161 Contract: CONSTRUCTION OF SUNCE & DE TUNNEL 7-10 (2800 m), 7-10 (2140 m)	ACCOM Inter PALK. If 134 43 3100 Mi BF, Infoy Type C. If 134 43 134 43 144 43 144 43 44 144 44 44 44 44 44 44 44 44 44 44 44 44
No.: YPH -1857-PMC-GDN-2205 09 July 2022 Te. Mr. Yashipal Singh Rathore, Project Manager Mr. Nazyuga Ragineering Company Ltd., RVNX. Camp. Packager S- Village & Pour: Maletha, Dist: Tehri Garhwal, Uttarakhand - 249161 Contract: CONSTRUCTION OF SINCLE BIG TUNNEL 7-9 (2800 m), T-10 (4140 m) WTH PARALLE, ISCAPE TUNNEL, STATION TABO AT SINALGA RAN has TO 73-010 WTH PARALLE, ISCAPE TUNNEL, STATION TABO AT SINALGA RAN has TO 73-010 WTH PARALLE, ISCAPE TUNNEL, STATION TABO AT SINALGA RAN has TO 73-010 WTH PARALLE, ISCAPE TUNNEL, STATION TABO AT SINALGA RAN has TO 73-010	ACCOM Inter PALK. BI 124 483 500 MI BF, binky Typer C, BF, binky Typer C, bink
No.: YPH -1857-PMC-GDN-2205 To, Mr. Yashpal Singh Rathore, Project Manager M/N Starpy and Singhering Company Ltd., RVNL Camp. Package-5 Village & Post: Maletha, Dist: Tehri Garhwal, Uttarakhand - 249161 Contract: Construct: Construction of SincLE Bis TUNNEL 74 (2800 m), T-10 (4140 m) MRIDGES AND OTHER AXCILLARY WORKS IN BIETWEEN (16. 631-464 km T0 73-018 k BIRDGES AND OTHER AXCILLARY WORKS IN BIETWEEN (16. 631-464 km T0 73-018 k BIRDGES AND OTHER AXCILLARY WORKS IN BIETWEEN (16. 631-464 km T0 73-018 k BIRDGES AND OTHER AXCILLARY WORKS IN BIETWEEN (16. 631-464 km T0 73-018 k BIRDGES AND OTHER AXCILLARY WORKS IN BIETWEEN (16. 631-464 km T0 73-018 k BIRDGES AND OTHER AXCILLARY WORKS IN BIETWEEN (16. 631-464 km T0 73-018 k BIRDGES AND FRAKAGE - 5 NI CONNECTION WITH NEW SINGLE BRAD CAUGE FAUL LIN BIRTWEEN RISSIRIESH AND KARANPRAVAG (125400) IN THE STATE OF UTTARAGUAN INDIA.	ACCOM Man PA LM. BY 124 483 3103 ML ACCOM Man PA LM. BY 124 483 3103 ML Grant Control of Marky Town C. Grant Control of Control o
No.: YPH -1857-PMC-GDN-2205 To, Mr. Yashpal Singh Rathore, Project Manager M/N Karyaya Engineering Company Ltd, RVNL Camp, Package-5 Willage & Post: Maletha, Dist: Tehri Garhwal, Uttarakhand - 249161 Gentract: CONSTRUCTION OF SINCLE IIG TUNNEL T-9 (2800 m), T-10 (4140 m) WITH PAGALER LSAPAT TUNNEL, STATION YAND AT SBUAGAR AND MALETHA, MINO BILDGIS AND OTHER ANCILARY WORKS IN ILETWEIN OI: 631-640 km T0 73-018 H UNDER PACKAGE - 5 NI CONNECTION WITH NYE SBUAGAR AND MALETHA, MINO BILDGIS AND OTHER ANCILARY WORKS IN ILETWEIN OI: 631-640 km T0 73-018 H UNDER PACKAGE - 5 NI CONNECTION WITH NYE SBUAGER INCOGE RAIL LB BITWEEN RISHIRSH AND KARANFRAVAG (125KW) IN THE STATE OF UTTARABUM NDIA.	ACCOM MED PALL, MACCOM MED PALL, St Many Town C, Guy Cycler City, Paner C, Guy Cycler City, Paner K, Guy Cycler City, Paner
No.: YPH -1857-PMC-CDN-2205 To, Mr. Yashpal Singh Rathore, Project Manager M/N Loanp, Package 5 Village & Post: Matcha, Dist: Tehri Garhwal, Uttarakhand - 24901 Gontract Constract	ACCOM MEN MALL MACCOM MEN MALL St Mahy Tane C. DU Cyter Cip. Pane A. Cup Cip. Cup Cip. Cup Cip. Cup Cip. Cup Cip. Cup Cip. Cip. Cup Ci
No.: YPH -1857-PMC-GON-2205 To, Mr. Yashpal Singh Rathore, Project Manager Mr. Nasyuga Engineering Company Ltd., RVNK Camp. Packager S- Nillage & Pour Maletha, Dist: Tehri Garbwal, Uttarakhand - 249161 Contract: CONSTRUCTION OF SURCE & DE CHUREL T-0 (2880 m), T-10 (9 140 m) BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 63+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN Ch. 61+660 han TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN CH. 10 TO 73-01 the BIDOES AND OTHER ANCILARY WORKS IN BITWEEN CH. 64 han TO 73-01 the BIDOES AND	ACCOM INTERVAL MENDON MEDICAL DU Calor Cap, Table DU Calor Calor DU Calor DU Calor Calor DU
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No.: YPH - 1857-PMC-GON-2205 09 July 2022 Te. Mr. Yashapal Singh Rathore, Project Manager Mr. Nasyuga Ragineering Company Ltd., RVN. Camp. Packages > Sillage & Ports: Malecha, Dist: Tehri Garbwal, Uttarakhand - 249161 09 July 2022 Contract: CONTENCTION OF SINCLE BE CONTENDED > 100 (100 mm) 00 Harrison (100 mm) Contract: CONTENCTION OF SINCLE BE CONTENDED > 100 (100 mm) 00 Harrison (100 mm) Berrarch: CONTENCTION OF SINCLE BE CONTENDED > 100 (100 mm) 00 Harrison (100 mm) Berrarch: CONTENCTION OF SINCLE BE CONTENDED > 100 (100 mm) 00 Harrison (100 mm) Berrarch: CONTENCTION OF SINCLE BE CONTENDED > 100 (100 mm) 00 Harrison (100 mm) Berrarch: CONTENCTION OF SINCLE BE CONTENT NY NUMBER INFORMED AND THE STATE OF UTTARABUMA NUMBER PARAGE AND MARTINE, MINK Berrarch: IN CONNECTION WITH MY SINKER BROAD, CANCER RAIL LIN BETWEEN SINKERSH AND KARANPRAYAG (125KM) IN THE STATE OF UTTARABUMA NUMBER Subject: Approval for PYC Water Proofing Membrane and Non-Woven Geotextile (10 L Millar and Company Lul., "for Engineery's review and initiating the procureme process with following reference Contractor had submitted the Technical Specification at Condential of The Hills rand Company Lul., "for Engineery's review and initiating the procureme process with following reference documents and Samples. 1. Technical Specification. 2. Millar and Company Lul., "for Engineery's review and initiating the procureme process with fol	ACCOM HIGH PALK. MICHAEL STATES OF THE STAT
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No.: YPH - 1857-PMC - CON - 2205 Or yuly 2022 Te, Mr. Shapla Singh Rathore, Project Manager Mr. Navyuga Ragineering Company Ltd., RYS, Camp, Packager S- Millage & Package. MYN, Camp, Packager S- Sillage & Package. Mr. Shapla Singh Rathore, Project Manager Mr. Navyuga Ragineering Company Ltd., RYS, Camp, Packager S- Sillage & Package. Centract: CONSTRUCTION OF SINCLE BEN NUMERIA, STATUS PACKAGE. Centract: CONSTRUCTION OF SINCLE BEN NUMERIA, STATUS PACKAGE. Subject: Approval for PYC Water Proofing Membrane and New Yoven Geotextile (2) Mrillar and Company Ltd., Status Numerican Mr. New Sincle BRADA Construction Numerican BETWEEN BUSINESSI AND KARANPRAYAG (125KW) IN THE STATE OF UTTARAKING Numerican Activity Status Sincle Sincle Sincle Beneficience Since Sinc	ACCOM INSURATION ACCOMPACE AND ACCOMPANENT AND ACTION AND ACTION AND ACCOMPANENT ACCOMPANE
No.: YPH - 1857-PMC - CON - 2205 Or yuly 2022 Te, Mr. Sahpad Singh Rathore, Project Manager Mr. Navyuga Ragineering Company Ltd., Roy Con - 2400 (1400 m) MYN Camp, Packager S- Sillage & Package. Mr. Sahpad Singh Rathore, Project Manager Mr. Navyuga Ragineering Company Ltd., Roy Con - 2400 (1400 m) MYN Camp, Package S- Sillage & Package. Mr. Sahpad Singh Rathore, Project Manager Mr. Navyuga Ragineering Company Ltd., Br. Tehri Garhwal, Uttarakhand - 249161 Centract: CONSTRUCTION OF SINGLE BG TUNNEL T-9 (2800 m), T-10 (4140 m) MYTH PARALLEL SCAPE TINNER, STATION TABO AT SINALGAR AND MA TO 75-Rotte E to No Construction WITH NWS NAUGLE BDADA Construction Barbore Rath. Ltd. BETWEEN SINHESH AND KARANPRAYAG (1255KN) IN THE STATE OF UTTARABUM MIN. No. 1000 Proceeding McMarane and New Yoven Geotextile (21 Millar and Company Ltd.): Rotte Subject: Approval for PVC Water Proofing Membrane and New Yoven Geotextile (21 Contractor Letter No. NEC/WYNL/PACKAGE-5/22-23/758 of dated 11.0.6.2022 Dear Sit, With above mentioned reference Constructor had submitted the Technical Specification an Geotentian to Education an Geotentian to Education an Geotentian reference Constructor had submitted the Technical Specification an Geotentian to Education and Geotentian to Education and Geotentian to Education and Geotentian to Education an Geotentian to Education and Geotentian to Education an Geotentian to Education to Company Ltd. is port Col. 1 and C. 2.3 of B	A COMMENDATE, MARKEN AND A COMMENDATE AND A COMMENDATION
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Description Ans: YPH - 1857-PMC GON - 2205 Yee With Analysiangha Rathore, Project Manager My Nayonga Ragineering Company Ltd, Rith Camp, Packages - Stillage & Ports: Matchia, Dist: Tehri Garhwal, Uttarakhand - 249161 Centract: CONSTRUCTION OF SINCLE BG TUNNEL T-9 (2800 mb), T-10 (4140 ml) MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGER AND MYTH PARALLEL RSCAPE TINNER, STATION YABO AT SINALGA AND MA TO PSAGE DESCRIPTION TO PSAGE AND MYTH PARALLEL RSCAPE TINNER (Description TINNER) Description MYTH PARALLEL RSCAPE TINNER (Description To PSAGE AND MYTH PARALLEL RSCAPE TINNER) Description MYTH TO PSAGE AND MYTH PARALLEL RSCAPE TINNER (Description TO PSAGE AND MYTH PARALLEL RSCAPE TINNER)	<text></text>
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THIRD PARTY TEST REPORT FOR "DR MILLARS" BRAND PVC GEOMEMBRANE

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o: COM I fice,Bk Il Plaza alimar I 4993	ndia Pvt Ltd. (A-BNI 3 rd Line Pr , Hosangabad Road Hotel, Obedullagan	oject, I, j, Diss-Rai	sen M.P Po	tport No. tter Ref. No. ate of Receipt triod of Testing ate of Report	- PTL/GEN/04793 -PMC/BPL/BKA-1 Dt:- 31/07/2021 - 05/08/2021 - 06/08/2021 - 28/0 - 28/08/2021 ource:- Dr. Millar ^m	BNI/MAX/178 38/2021		Issue M/S PMC New Near India	d to: AECOM India Pvt Ltd. Office,BKA-BNI 3 rd Lins Toll Plaza, Hosmgabad R Shalimar Hotel, Obedulla +464993	Project, ead, ganj, Diss-Ra	Rej Let Dat isen M.P Per Dat	port No. :- PT tter Ref. No. :-PM Dt: te of Receipt :- 05 riod of Testing :-06/ te of Report :- 28 Drem thick) "Source	TL/GEN/04793 4C/BPL/BKA-BN :- 31/07/2021 508/2021 -08/2021 -08/2021 -08/2021 -08/2021 -08-00, Millar [®]	1/MAX/178, 2021	
f Work	2-Construction of f Electrified Broa Bhopal Division State, India 3 rd 1	ive tunnels ad Gauge R n of West C Line Betwe	Cut & Cover aiway Line Bet entral Railway en Barkhera-Bo	with Ballast less ween Barkhera-I in Sehore and R adni (26.5km)"	track in connection Budni on Bhopal-Ita aisen Districts of M	with 3 rd Irsi Route on Jadhya Pradesh		Sam S. No.	Test	Units	Test Method	Result	Requiren As per cust	nent Co	afors
de M/s	(CA No. RVNL/ Max Letter's No.	Bhopal/BH MIIL/RVN	CA-BNI(Tunn)	el) Date:-27.02.2 pal/2020-21/424	019) 1, dtd 31.07.2021 1am IDS /264 / Max/	PUC Mamile	164 Welder	1 3 3 3	Failure, a. Longitudinal direction	_	DIN 16726	+4.7	+10%, M	ax.	Yes
Test	ry :- M/s Max intr	Units	Test Method	Resul	Requir	ement	Conformity		b. Transverse direction Folding at a temperature	-		No fissures	No fissur	res	Yes
hicknes		mm	DIN 53370	2.04	As per o	tin.	Yes	9.	Water Absorption	%	DIN 53495	0.06	1 Max.		Yes
ensile S	trength	N/mm ²	DIN 53455					10.	Behaviour after storage i acid and/ or alkaline solutions:		DIN 16726				
Longita Transv	adinal direction crise direction		3333	20.11	15 N 15 N	din. din.	Yes		Variation of Tensile a. Longitudinal direction			Awaited	.+20% Mi	ax.	
longatio	on at Break	. %	DIN 53455	144	250.1	Min	Yes		b. Transverse direction Variation of Elongation a	t	1	Awaited	#20% Ma	ex.	
Transv	erse direction			379	2501	Min.	Yes		Failure a. Longitudinal direction			Awaited	#20% M	EX.	•
ompres 0% Stra	sive Strength at iin (10mm cube)	N/mm*	DIN 53454	8.15	2.5 1	stat.	Tes		b. Transverse direction Folding at a temperature			Awaited	No fissur	nes	•
ear Pro	pagation Strength	Num	UNIN 53363	125.5	7 100 1	Min.	Yes	11.	Shear Strength of Splice	N/50	DIN 16726	138	100N/30 r	mm	Yes
Transv	ense direction		DID LETS	115.0	2		Yes	12.	Behaviour During Perforation Test	mm	DIN 50014	No perforation observed	No perfora 750mm heig	tion ght of	Yes
creagth	on weided Seam	mm 44	DIN 16726	0.06	+/-2	Max.	Yes		Witness Darker Chr. 4	TICE/ BMC	Atul Nieam (Phi	(C) Arun Jut (Sr. OC	C. Max infra) & V	ikash (Dr. Mille	er)
ccelerat	ing ageing Characteristics							Ter	e walness by Mr. 5 Modi	CE PAC	**End	of Report**			
uring a 0 °C	nd After storage at		DIN 16726		tare bi-ro	listen	Ver					11216			
imensio	Appearance seal Stability			No Blis	No II	Max	Yes								
Longin Transv	erse direction		334.0	0.07	-3%	Max.	Yes								
Longit	a of Tensile adinal direction		3353	+2.4	+10%	Max. Direct	Yes Yes							Direc	ctor
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