Pipe Coating Solution

+ 3-Layer Anti-corrosion Pipe Coating System

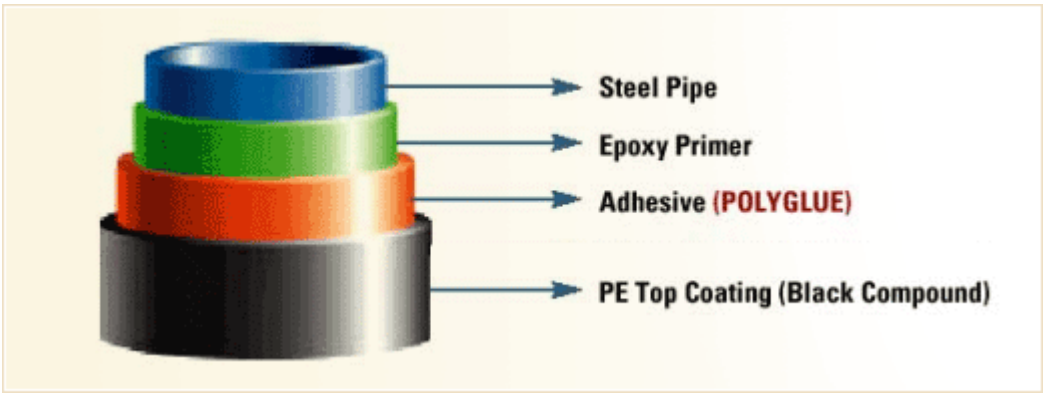
Ever since SK had started development of polyolefinic adhesive and top-coat resins for 3-layer anti-corrosion pipe coatings in 1989, we brought the first products into the market under the name of POLYGLUE ® (adhesive) and its already well published name of YUCLAIR ® in 1993.
Together with FBE coating and 2-layer polyethylene coating system, 3-layer coating practice has now become industry standard in the most demanding on- and off-shore pipeline projects. In contrast to the single layer fusion bonded epoxy powder coating system, each component layers of 3-layer coating system devote to multi-lateral protection of the pipe, i.e., epoxy layer adheres to steel pipe surface acting as the main anti-corrosion countermeasures, and then tie layer firmly attach outer polyethylene top-coat to the inner epoxy layer. Top-coat endows remaining mechanical and functional protection to the whole system.
The key factors to the reliable serviceability of the 3-layer coating system are the strong bonding of adhesive layer to both epoxy and top-coat layers over the full service temperature range (up to 80℃) and the ability of top-coat material to withstand various environmental stresses during the life of the coated pipe, i.e. storage, transportation and installation not to mention, its operation stage.
SK's POLYGLUE ® and YUCLAIR ® for pipe coating application have proved themselves to be effective solution during the last decade for many international applicators and/or projectors as shown by our experience in this field.

◈ Requirements of Each Component Materials for 3-layer Anti-corrosion Pipe Coating System

Epoxy primer layer should,
- form a continuous film of strong bonding to the steel surface by interacting with its oxides
- provide reaction sites to the adhesive layer for chemical bondage.
- endow high chemical resistance and resistance to cathodic disbond flexibility allowing cold bending under the field condition

Adhesive tie layer should provide powerful bond between inner epoxy primer layer and outer PE top-coat layer by
its anhydride functional group grafted onto its polyethylene back bone

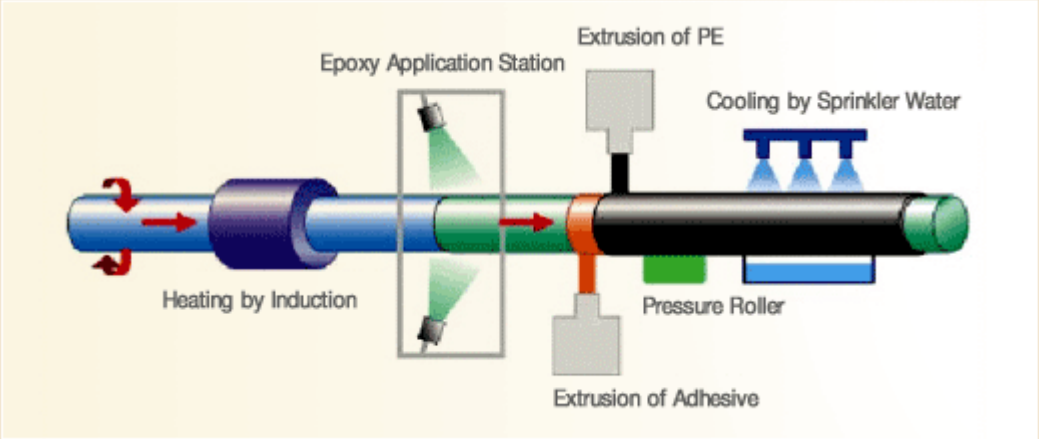
Top coat layer should,
- provide high mechanical, chemical resistance and anti-corrosive properties
- allow long term UV stability and thermal stability



Requirements of steel pipe coatings system under DIN30670 standard

Physical properties	Unit	DIN30670 Normal class'N'	DIN30670 Special class'S'	SK system Yuclair ET509B
Continuity (dielectric)	kV	>25	>25	>25
Bond strength 20 ± 5℃ 50 ± 5℃	 N/cm N/cm	 >35 >15	 >35 >25	 >150 >50
Impact strength at 25 ℃ / No electric breakthrough	J/mm	>5	>5	>10
Indentation hardness 23 ± 2℃ 50 ± 2℃ 70 ± 2℃	 mm mm mm	 < 0.2 < 0.3 -	 - - < 0.3	 < 0.1 < 0.1 < 0.2
Percentage elongation at failure	%	>200	>200	>400
Coating resistivity	Ωm ^{2}	>10^8	>10^8	>10^{10}
Heat aging 100days/100 ℃ (MFR) 200days/100 ℃ (MFR)	 % change % change	 < 35 -	 - < 35	 < 35 < 35
Light aging, 7GJ/m $_2$ (MFR)	% change	< 35	< 35	< 35

Anti-corrosion 3-layer coating process



◈ Physical Properties of POLYGLUE®

Physical properties	Unit	Test Method	LE149V	LE200T	LE100A
Melt Flow Rate at 190℃/2.16kg	dg/min	ASTM D1238	1.6	4.0	4.9
Density	g/cm^3	ASTM D792	0.921	0.927	0.916
Tensile Strength at Break	kg/cm^2	ASTM D638	200	180	180
Ultimate Elongation	%	ASTM D638	850	800	820
Hardness	Shore D	ASTM D2240	48	47	47
Vicat Softening Point	℃	ASTM D1525	102	102	86
Brittleness Temperature	℃	ASTM D746	< -70	< -70	< -70
Melting point	℃	ASTM D3418	121	121	120
Water Absorption	℃	ASTM D570	< 0.01	< 0.01	< 0.01

◈ Physical Properties of Top-coat Polyethylene

Physical properties	Unit	Test Method	SK ET509B (typical)
Melt Flow Rate at 190℃/2.16kg	dg/min	ASTM D1238	0.30
Density	g/cm^3	ASTM D792	0.949
Tensile Strength at yield	kg/cm^2	ASTM D638	180
Tensile Strength at Break	kg/cm^2	ASTM D638	300
Ultimate Elongation	%	ASTM D638	800
Hardness	Shore D	ASTM D2240	60
Vicat Softening Point	℃	ASTM D1525	120
Brittleness Temperature	℃	ASTM D746	< -70
Melting point	℃	ASTM D3418	128
ESCR (F50 , 10% Surfactant)	Hr	ASTM D1693	>1,000
Water Absorption	wt %	ASTM D570	< 0.01
Carbon Black Content	wt %	ASTM D1603	2.0
Oxygen Induction time at 220℃	min	ASTM D3896	15
Volume resistivity	Ωm	ASTM D257	$>10^{16}$
Dielectric withstand	kV/mm	ASTM D149	38

◈ Compatibility Data of SK's Adhesive and PE Top-coat Materials with Other Products

Epoxy Primer (Manufacture)	Adhesive co-polymer (Manufacture)	Adhesive co-polymer (Manufacture)
BASFOX PE-50-1081 (BASF)	LE149V	YUCLAIR ET509B (SK Corp.)
EP-971197 / EP-F-2001 (Jotun)	LE200T	HE3450, ME6060 (Borealis)
Scotchkote 228 (3M)		Sclair 35BP, 35BPM (Nova)
Karumel EX 4413 (KCC)	LE100A	Lacqtene 2006 PBK 35 (Elf-Atochem)
Eurokote 71441 (Elf-Atochem)		Lupolen 3653 DSW (Basell)

◈ Quality Control System for POLYGLUE ® and PE To p - c o a t

To maintain uniform quality level, we are conducting regular product bactch-wise test over the below properties in plant and R&D Center. The standard of control system is as following.

In-house POLYGLUE ® quality control regulation

Test Item	Test Method	Inspection Cycle
Melt Flow Rate	ASTM D1238	Per 30 min
Density ASTM D792 Per Lot.	ASTM D792	Per Lot.
Tensile Strength at Break	ASTM D638	Per Lot.
Elongation at Break	ASTM D638	Per Lot.

Hardness	ASTM D2240	Per Lot.
Vicat Softening Point	ASTM D1525	Per Lot.
E.S.C.R	ASTM D1693	Annually
Water Absorption	ASTM D570	Annually
Brittleness Temperature	ASTM D746	Annually
Oxygen Induction Time	ASTM D3896	Quarterly
Melting Point	ASTM D3418	Quarterly
Peel Strength	SK Method	Per 1 Hour

In-house PE top-coat quality control regulation

Test Item	Test Method	Inspection Cycle
Melt Flow Rate*	ASTM D1238	Per 30 min
Density ASTM D792 Per Lot.	ASTM D792	Per Lot.
Tensile Strength at Break	ASTM D638	Per Lot.
Elongation at Break	ASTM D638	Per Lot.
Hardness	ASTM D2240	Per Lot.
Vicat Softening Point	ASTM D1525	Per Lot.
E.S.C.R	ASTM D1693	Annually
Water Absorption	ASTM D570	Annually
Brittleness Temperature	ASTM D746	Annually
Oxygen Induction Time	ASTM D3896	Quarterly
Melting Point	ASTM D3418	Quarterly

- Attachment 1. A Marketing History
- Attachment 2. Reference

SK Corporation

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Fax : +82-2-2121-7001

Online /
SK Corporation : www.skcorp.com
Chemical Business : www.skchem.com

SK Corporation
99,Seorin-Dong Jongro-Gu, Seoul ,Korea
TEL:82-2-2121-6487, FAX:82-2-2121-6937

Past Reference of Sales

No.	Applicator	Products	Project Name	User	Year
1	Hyundai Metal Indonesia	- Polyethylene ET509B: 3,500MT - Co-Polymer Adhesive LE149V: 330MT	Domestic Pipeline coating Project	PGN Indonesia	1997
2	PSL Holdings Ltd.	- Polyethylene ET509B: 900MT - Co-Polymer Adhesive LE149V: 90MT	Jamnagar-Loni LNG Pipelines coating Project	Gas Authority of India	1999
3	Petrojet	- Co-Polymer Adhesive LE100A: 407MT	Domestic Pipeline coating project	Egyptian Government	1999
4	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 160MT	Loop II Project	PETRONAS	1999
5	Crescent Steel	- Polyethylene ET509B: 229MT	Domestic Oil Pipeline coating Project	Pakistan Government	1999-2000
6	Yadong Anti-Corrosion Hualong Petroleum Anti-Corrosion	- Co-Polymer Adhesive LE200T: 287MT	Domestic Gas Transportation Pipeline Project	CNPC	2000-2001
7	SAW Pipes Ltd.	- Polyethylene ET509B: 160MT - Co-Polymer Adhesive LE149V: 160MT	Baruni-Patna Pipeline Project	Indian Oil Company Ltd.	2000
8	Al-Qahtani Pipe Coating Terminal	- Polyethylene ET509B: 40MT - Co-Polymer Adhesive LE200T: 4MT	Domestic Oil Pipeline coating Project	ARAMCO	2000
9	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 30MT	Loop III Project	PETRONAS	2000
10	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 120MT	Fahud Sohar Gas Pipeline Project	Oman Government	2001
11	PSL Holdings Ltd.	- Polyethylene ET509B: 480MT - Co-Polymer Adhesive LE149V: 48MT	Para-deep Pipeline Project	Indian Oil Company Ltd.	2001
12	Yadong Anti-Corrosion Hualong Petroleum Anti-Corrosion	- Co-Polymer Adhesive LE200T: 336MT	West-East Pipeline Project	CNPC	2001-2002
13	Dongsung C-Tech	- Co-Polymer Adhesive LE149V: 120MT	Aleppo-Palmyra Gas Pipeline Project	Syrian Petroleum Co.	2001

SK Corporation
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No.	Applicator	Products	Project Name	User	Year
14	Petrojet	- Co-Polymer Adhesive LE100A: 15MT	Offshore Gas Pipeline Project	EGPC	2001
15	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 465MT	In Salah Gas Development Project	BP & Sonatrach	2002
16	Ahwaz Pipe Mills	- Polyethylene ET509B: 880MT - Co-Polymer Adhesive LE149V: 120MT	Domestic Oil Pipeline coating Project	NIOC	2002
17	PSL Holdings Ltd.	- Polyethylene ET509B: 748MT - Co-Polymer Adhesive LE149V: 80MT	Vizag-Secondrabad Pipeline Project	EIL	2002
18	Yadong Anti-Corrosion	- Polyethylene ET509B: 690MT	Onshore Pipeline Project	CNOOC	2002
19	Petrojet	- Co-Polymer Adhesive LE200T: 225MT	Egyptian Gas Transmission Network	EGPC	2002
20	WISTCO	- Polyethylene ET509B: 56MT - Co-Polymer Adhesive LE149V: 5MT	West Semo PM (Oil Station Construction)	Indonesian Government/ Unocal	2002
21	DATA Steel	- Polyethylene ET509B: 65MT - Co-Polymer Adhesive LE149V: 28MT	SSGC Gas Pipeline Project	SSGC	2002
22	Crescent Steel	- Polyethylene ET509B: 75MT	SSGC Gas Pipeline Project	SSGC	2002
23	Socotherm Australia	- Co-Polymer Adhesive LE149V: 48MT	Sea Gas Pipeline Project: 673Km, 18” (Port Campbell To Pelican Point)	Southeast Australia Gas Pty	2002
24	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 445MT	BTC Pipeline project	BP Consortium	2002-2003
25	C.P.E.C.C.	- Polyethylene ET509B: 4,180MT - Co-Polymer Adhesive LE149V: 720MT	White Oil Pipelines Project in Pakistan	PARCO, SHELL, PSO, CALTEX	2003
26	C.P.T.D.C.	- Polyethylene ET509B: 3,124MT - Co-Polymer Adhesive LE200T: 282MT	Sudan Fula Oil Shipping Pipeline Project: 600Km, 24”(Fula oil field----Khartoum)	SUDAN Government	2003
27	C.P.T.D.C.	- Polypropylene PT900W: 770MT - Co-Polymer Adhesive RE340B: 62MT	Sudan Fula Oil Shipping Pipeline Project: 110Km, 24”(Fula oil field----Khartoum)	SUDAN Government	2003

SK Corporation
99,Seorin-Dong Jongro-Gu, Seoul ,Korea
TEL:82-2-2121-6487, FAX:82-2-2121-6937

No.	Applicator	Products	Project Name	User	Year
28	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 92MT	Sakhalin II Project	S.E.I.C.	2003-?
29	Shinho Korindo	- Co-Polymer Adhesive LE149V: 15MT	Indonesia Domestic Project		2003
30	SAW PIPES LTD.	- Co-Polymer Adhsive LE149V: 40MT	Mora Sajod Gas Pipeline Project	IOCL	2003
31	Bredero Shaw Australia PTY	- Co-Polymer Adhesive LE851P: 100.2MT	Enertrade Project	Enertrade	2003-2004
32	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 400MT	SCP(South Caucasus Pipeline) Pipeline project	BP Consortium	2004-?
33	PPSC Malaysia	- Co-Polymer Adhesive LE149V: 138MT	Trans Thai Malaysia Project	T.T.M. Limited	2004-?
34	PSL Limited	- Polyethylene ET509B: 600MT - Co-Polymer Adhesive LE149V: 64MT	Nalka-Bogra Gas Transmission Pipeline	Gas Transmission Company Ltd. (GTCL)	2004
35	Petrojet	- Polypropylene PT900W: 250MT - Co-Polymer Adhesive RE340B: 20MT	Burullus Gas Simian Sienna/Sierra & Sapphire Project	KHALDA Petroleum Company	2004
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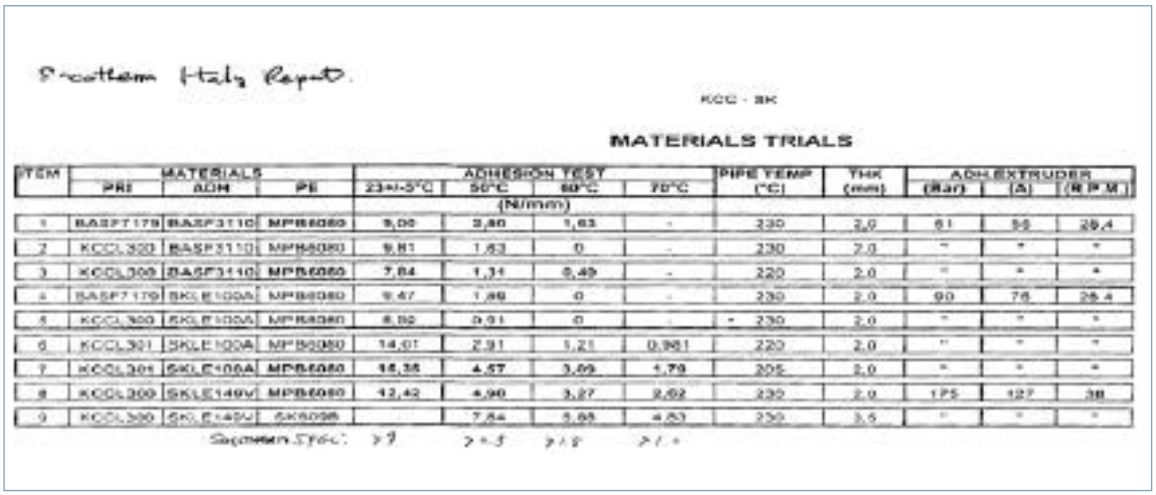
References

References



Socotherm Italy Report.

KCC - SK

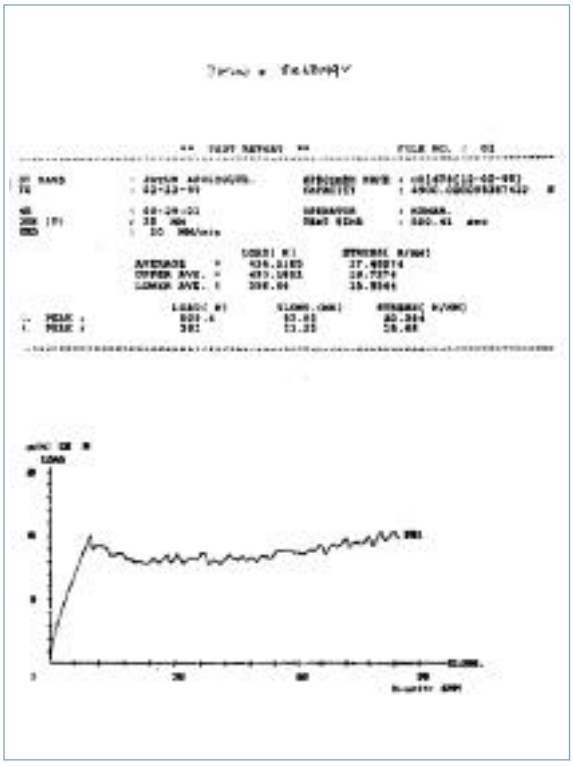
MATERIALS TRIALS

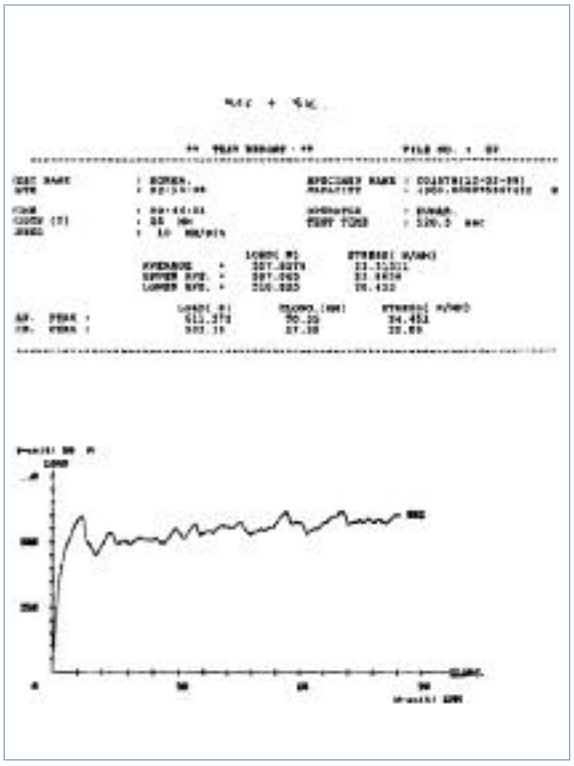
ITEM	MATERIALS PRI	MATERIALS ADH	MATERIALS PE	ADHESION TEST 23+/-5°C	ADHESION TEST 50°C	ADHESION TEST 65°C	ADHESION TEST 75°C	PIPE TEMP (°C)	THK (mm)	ADH.EXTRUDER (Bar)	ADH.EXTRUDER (A)	ADH.EXTRUDER (R.P.M.)
				(N/mm)								
1	BASF7179	BASF3110	MPB6080	9.00	2.80	1.63	-	230	2.0	61	56	29.4
2	KCCL300	BASF3110	MPB6080	9.81	1.63	0	-	230	2.0	"	"	"
3	KCCL300	BASF3110	MPB6080	7.84	1.31	0.49	-	220	2.0	"	"	"
4	BASF7179	SKLE100A	MPB6080	9.47	1.88	0	-	230	2.0	90	76	26.4
5	KCCL300	SKLE100A	MPB6080	8.32	0.91	0	-	230	2.0	"	"	"
6	KCCL301	SKLE100A	MPB6080	14.01	2.91	1.21	0.961	220	2.0	"	"	"
7	KCCL301	SKLE100A	MPB6080	16.35	4.57	3.09	1.79	205	2.0	"	"	"
8	KCCL300	SKLE149V	MPB6080	12.42	4.90	3.27	2.62	230	2.0	175	127	38
9	KCCL300	SKLE149V	SK6098		7.84	5.88	4.83	230	3.5	"	"	"

Specification: >9 >4.5 >2.9 >1.4

Socotherm Italy

Adhesion Strength Test result at Socotherm Italy.
SK's adhesives (LE100A/LE149V) were tested with combinations of other Epoxies and PE Top Coat material for its Adhesion Strength at various temperature (through item 4 to 9)





PPSC in Malaysia

Adhesion Strength Test result
From PPSC in Malaysia on June '99.
Epoxy: EP1197,Jotun
Adhesive: LE149V, SK

PPSC in Malaysia

Adhesion Strength Test result
From PPSC in Malaysia on June '99.
Epoxy: L-300, KCC
Adhesive: LE149V, SK

References

PT PERUSAHAAN GAS NEGARA (PERSERO)
INDONESIA GAS TRANSMISSION PROJECT

RAW MATERIAL CERTIFICATE

No. : 133/06/69010/1999

We would like to state that we had used adhesive Co-Polymer and PE from SK Corporation on our below Gas Pipeline Project through PT. Hyundae Metal Indonesia.

And we fully satisfy the three (3)-layer coated pipe in quality from the above pipe coater.

Project : External Coating of 28" Dia. Linepipe for Gas Transmission and Distribution Project, Central Sumatera - Indonesia (PE 3-layer 584 Km, 1996 – 1997)

Raw Material :

Adhesive Co – Polymer : SK Corp. POLYGLUE LE149V

PE : SK Corp. YUCLAIR MDPE w/Carbon Black Compounded)

Jakarta, May 10, 1999

Gas Transmission and Distribution Project
Central Sumatera

Iwan Heryawan
Project Manager

PT Perusahaan Gas Negara

PT Perusahaan Gas Negara has approved to use SK's Adhesive LE149V and PE Top Coat material ET509B for its gas transmission and distribution pipeline project (1999)

PETRONAS GAS BERHAD

Ref. : [illegible] (L.104)
Date : 13 March 1999

BICOM PETRO-PIPES SDN BHD.
Lot 298, Jalan PKNK 3, Fasa 2,
Kawasan Perusahaan Sungai Petani
08000 Sungai Petani,
Kedah Darul Aman

Attn : Mr. G. Jayanathan
Managing Director.

Dear Sir,

THE SUPPLY, COATING, DELIVERY AND STORAGE OF PIPES FOR PGU LOOP 1 PROJECT
- PROBATIONARY APPROVAL FOR COMMERCIAL PRODUCTION OF KARUMEL EX-4413-L300 (PRIMER) AND POLYGLUE LE 149V (COPOLYMER ADHESIVE)

PGB refers to your letter [illegible] dated 02 March 1999.

PGB have reviewed the following test reports and found that they meet requirements :

NO.	REPORT NO.	TEST DATE	TEST	MATERIALS		
				PRIMER	ADHESIVE	TOPCOAT
1	[illegible]	[illegible]	Peel Adhesion Test at Room Temp.	[illegible]	SK Polyglue LE 149V	Etilinas [illegible]
2	[illegible]	[illegible]	48 Hour Cathodic Disbondment Test at 65 °C Temp.	[illegible]	SK Polyglue LE 149V	Etilinas [illegible]
3	[illegible]	[illegible]	Peel Adhesion Test at Room Temp.	Karumel EX-4413-L300	SK Polyglue LE 149V	Etilinas [illegible]
4	[illegible]	[illegible]	48 Hour Cathodic Disbondment Test at 65 °C Temp.	Karumel EX-4413-L300	SK Polyglue LE 149V	Etilinas [illegible]

Petronas

Petronas has approved SK's LE149V to be used in conjunction with Karumel (Epoxy, KCC) and PE Top Coat of Etilinas.

References

PSL in India

Complete 3-layer system adopting Karumel L-301 of KCC/LE149V of SK/ET509B of SK was line tested by PSL's coating plant

TRIAL REPORT

A 3 LPE COATING TRIAL HAS BEEN CONDUCTED ON 25.10.98 WITH FOLLOWING COATING RAW MATERIAL

1) PE : HDPE YUCLAIR ET 509 B
2) ADHESIVE : POLYCLUE LE 149 V
3) EPOXY : KARUMEL EX 4413 L 301 (IVORY)

PROCESS	CHECK ITEM	RESULT / REMARKS
LINE	1. LINE SPEED 2. PIPE SIZE OD 3. PIPE WALL THICKNESS 4. PIPE LENGTH 5. CAPACITY 6. COATING SYSTEM	2.3 MTRS / MINUTE 12 " 10.31 mm 12 MTR x 5 NOS. = 60 MTRS 500 PIPES PER DAY 3 LAYER PE
PRE - HEATING (FOR BLAST)	1. PREHEATING	NOT CONDUCTED
BLAST CLEANING	1 MATERIAL 2 DEGREE OF CLEANING 3.SURFACE PROFILE 4.SURFACE CONTAMINATION	STEEL GRIT SA 2 1/2 - SSPC SP-10 50 - 70 MICRONS NOT CONTAMINATED
WASHING	1. WASHING	NOT CONDUCTED
PRE - TREATMENT	1. CHEMICAL PRE -TREMENT	NOT CONDUCTED
PRE - HEATING	1. METHOD 2. TEMPERATURE 3. TEMP. CHECK 4. TIME TO SPRAY	INDUCTION 190 - 200 DEG C PYROMETER / IR 40 SECONDS
POWDER SPRAY	1. METHOD 2. SPRAY GUN 3. SPRAY EQUIPMENT MODEL 4. VOLTAGE 5. POWDER FEED RATE 6. PATTERN 7. DRY FILM THICKNESS 8. SURFACE TEMP. (AFTER SPRAY) 9. POWDER SPRAY TIME	ELECTROSTATIC 4 NOS MITSUBA 60 TO 70 KV 300 GM / MIN/ GUN SPIRAL 50 - 70 MICRONS 190 DEG C 12 SEC.
ADHESIVE	1. ADHESIVE RESIN GRADE 2. EXTRUDING TEMP 3. TIME TO WRAP (AFTER SPRAY)	POLYCLUE LE 149 V 190 DEG C 12 SEC.

PROCESS	CHECK ITEM	RESULT / REMARKS
POLYETHYLENE WRAPING	1. PE GRADE 2. EXTRUDING TEMP.	HDPE ET 905 B 220 DEG C
QUENCHING	1. TIME TO QUENCH (AFTER SPRAY) 2. TOTAL QUENCHING TIME 3. TEMP. AFTER QUENCH	60 SEC. 8 MINUTES 50 DEG C
INSPECTION	1. HOLIDAY INSPECTION 2. PEEL ADHESION DIN 30670 3. COATING THICKNESS	25 KV OK 2.2 mm
QUALIFY	1. IMPACT TEST TEST TEMP. SPECIFICATION 2. INDENTATION TEST AT 25 DEG C & 70 DEG C 3. ELONGATION	OK 25 DEG C 7 NM/mm OF COATING THICKNESS OK AVG. 324 % - OK

FOR PSL HOLDINGS LIMITED

P.H.SINGARE

References

PT. HYUNDAE METAL INDONESIA

To : SK Corporation
Address : 26-4 Youido-dong, Youngdungpo-gu, seoul, Korea
From : PT. Hyundae Metal Indonesia

Certification of the raw material

This is to certify that We have adopted and used well the below raw material for 3 layer steel pipe coating in the Gas Transmission and Distribution Project Sumatra, Indonesia (550 km).
Also We satisfy the performance of pipe product coated by the below raw material.

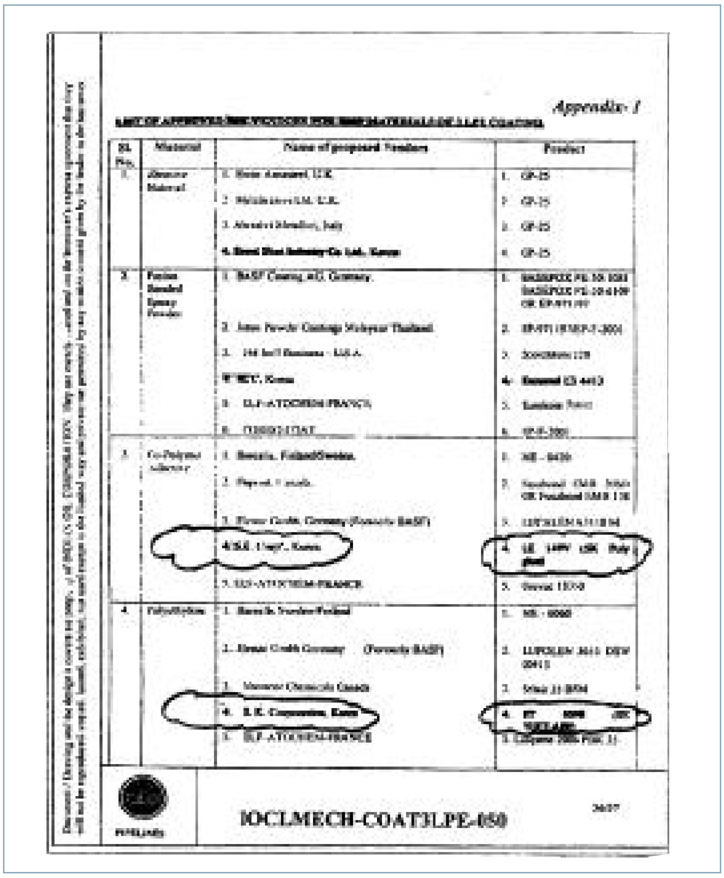
- Adhesive Co-polymer : SK Corp. POLYGLUE LE149V
- PE : SK Corp. YUCLAIR(MDPE)

PT. Hyundae Metal Indonesia

President Director

PT Hyundae Metal

Material Certification from PT Hyundae Metal was issued after they finished pipeline project of total length 550Km in Indonesia using LE149V and ET509B.



Appendix- I

Sl. No.	Material	Name of proposed Vendors	Product
1.	Abrasive Material	1. [illegible], U.K. 2. [illegible], U.K. 3. [illegible], Italy 4. [illegible] Co. Ltd., Korea	1. GP-25 2. GP-25 3. GP-25 4. GP-25
2.	Fusion Bonded Epoxy Powder	1. BASF Coating AG, Germany 2. [illegible] Powder Coatings Malaysia/ Thailand 3. [illegible] - U.S.A. 4. [illegible], Korea 5. ELF-ATOCHEM FRANCE 6. [illegible]	1. [illegible] 2. [illegible] 3. [illegible] 4. [illegible] 5. [illegible] 6. [illegible]
3.	Co-Polymer Adhesive	1. Borealis, Finland/Sweden 2. [illegible], Canada 3. [illegible] GmbH, Germany (Formerly BASF) 4. S.K. Corp., Korea 5. ELF-ATOCHEM-FRANCE	1. ME - 0420 2. [illegible] 3. LUPOLEN [illegible] 4. LE 149V (SK Polyglue) 5. [illegible]
4.	Polyethylene	1. Borealis Sweden/Finland 2. [illegible] GmbH Germany (Formerly BASF) 3. [illegible] Chemicals Canada 4. S.K. Corporation, Korea 5. ELF-ATOCHEM-FRANCE	1. ME - 6060 2. LUPOLEN [illegible] 3. [illegible] 4. [illegible] YUCLAIR 5. [illegible]

IOCLMECH-COAT3LPE-050

Indian Oil Company Ltd.

IOCL has put the name of SK into its Vendor List (LE149V and ET509B)

References

Qualty Control

> Certification

ISO 9001 (1994),
ISO14001 (1996),
KOLAS (1999): Korea Laboratory Accreditation Scheme

> Quality Control System

By the standard of ISO 9001, SK Corporation has quality control system. All the physical properties of POLYGLUE® are estimated by Quality Control System and issued in the form of analysis test report at every batch.

> Evaluation of Physical Properties

ASTM (American Standard Test Method) is the evaluation standard of quality control and technical service.
And we do estimate all the characteristics of materials according to this standard.
SK R&D center is a officially authorized institute by KOLAS (Korea Laboratory Accreditation Scheme).

I ISO 9001 (1994)

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of

SK Corporation
Seoul & Ulsan, Korea

has been approved by Lloyd's Register Quality Assurance Limited to the following Quality Management System Standards:

ISO 9001:1994
BS EN ISO 9001:1994
KS A 9001:1995

The Quality Management System is applicable to:

Development and manufacture of lubricants. Manufacture of petroleum products, asphalt, base oil, sulfur. Basic organic chemicals, aromatic compounds, solvents and synthetic resins. Storage and distribution by pipe line, rail tanker, road tanker and sea of SK Corp. manufactured products.

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

Approval Certificate No: 530000

Original Approval: 26th November 1993
Current Certificate: 3rd December 1998
Certificate Expiry: 30th November 2002

on behalf of LRQA Korea

References

KSA·QA

ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATE

Certificate No. EAC-00162

SK COPORATION ULSAN COMPLEX

Korea Standards Association Quality Assurance certify that the Environmental Management System of the above company has been assessed and found to be in accordance with the requirements of the environmental standards and scope of supply detailed below

ENVIRONMENTAL STANDARDS

KS A 14001 : 1996 ISO 14001 : 1996

SCOPE OF SUPPLY

VALID PERIOD

9TH NOVEMBER 1999 ~ 8TH NOVEMBER 2002

for KOREAN STANDARDS ASSOCIATION QUALITY ASSURANCE

DATE 9TH NOVEMBER 1999

ISO 14001 (1996)

KOLAS

No.BI(1/5)

CERTIFICATE OF ACCREDITATION

Name of Laboratory : SK Corporation, Daeduk Institute of Technology

Representative : Lee, Byung Hyung

Address : 140 1, Wonchon-dong, Yusong-gu, Taejon 305-712, Korea

Duration : 1998. 9. 30 ~ 2003. 9. 29

Scope of Accreditation

(Scope of Accreditation is described in the accompanying Annex)

This is to certify that above mentioned Laboratory has been accredited as the Testing Laboratory in accordance with the Provisions of Article 23 of the National Standardization Act.

These criteria encompass the requirements of ISO/IEC 17025.

1998. 12. 1.

Head,

Korea Laboratory Accreditation Scheme(KOLAS)

KOLAS (1999)

SK Corporation

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