SolutionPartner

LG Chem

Introduction of LG PE-RT Material

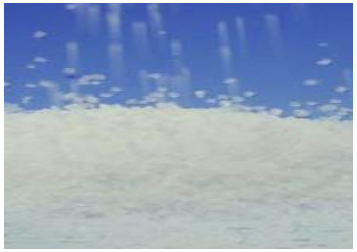
LUCENE™ SP980 & SP988

PE-RT Characteristics

※PE-RT : Polyethylene of Raised Temperature Resistance

- Excellent Physical & Good Thermal Properties
- Ideal for Hot Water Pipe & Radiating System

Type I : $8.3 < \sigma_{LPL} < 9.3$	→	UFH (Surface Heating)
Type II : $9.3 \leq \sigma_{LPL}$ (No Brittle Failure)	→	Plumbing (Hot & Cold water)



Non - Cross linking !!!
Only one - step Processing !!!

High line speed
Max 40m/min

Low cost
Simple process

Easy handling
Flexibility

PE-RT Application

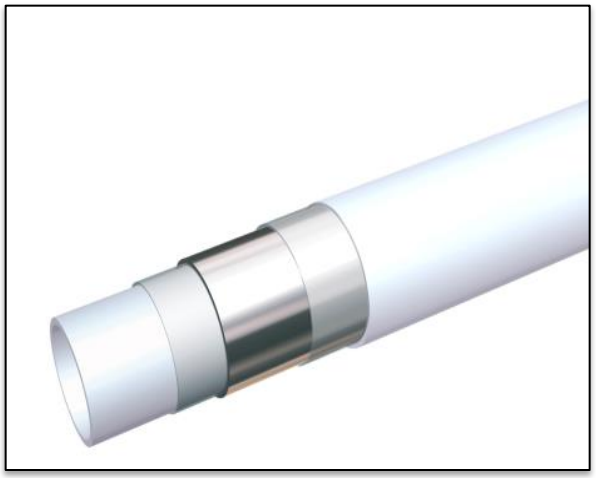
UFH

Plumbing (Hot & Cold water)

Radiator connection

Portable water

Snow Melt System



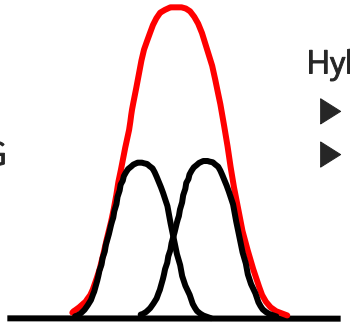
MLCP(Multi Layer Composite Pipe)

LG PE-RT Characteristics

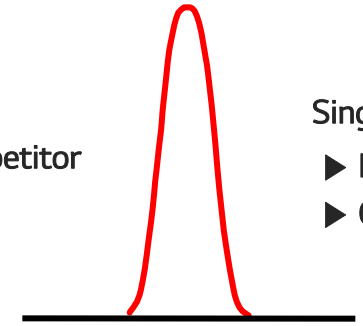
1) LG PE-RT Produced by using proprietary Metallocene catalyst technology (LUCENE™)

Well-designed "Molecular architecture" & "Co-monomer Distribution"

Molecular architecture of LG PE-RT



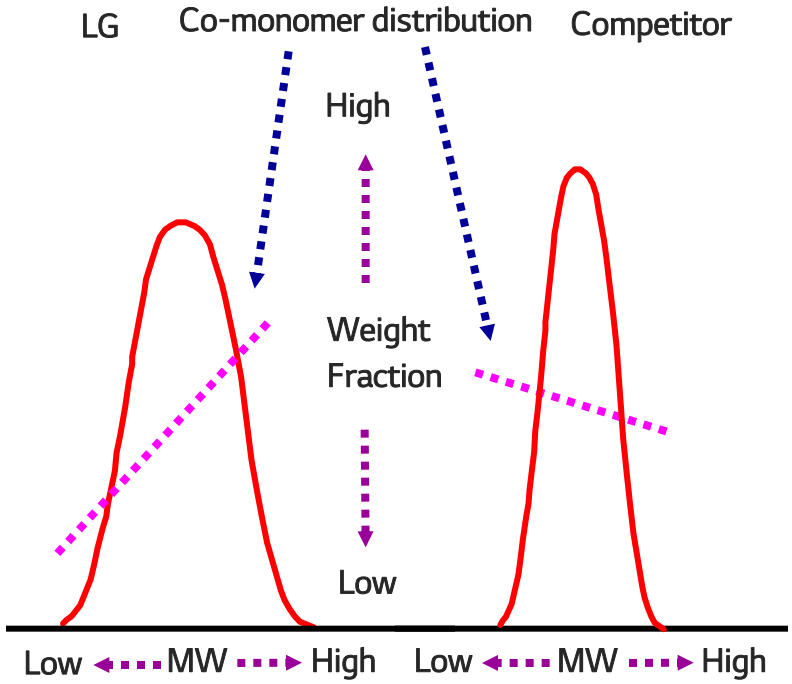
Hybrid Catalysts
- Broader MWD
- Easier & Good Processing



Single Catalyst
- Narrow MWD
- Common Processing

Excellent processing ability due to broad MWD

Co-monomer Distribution of LG PE-RT

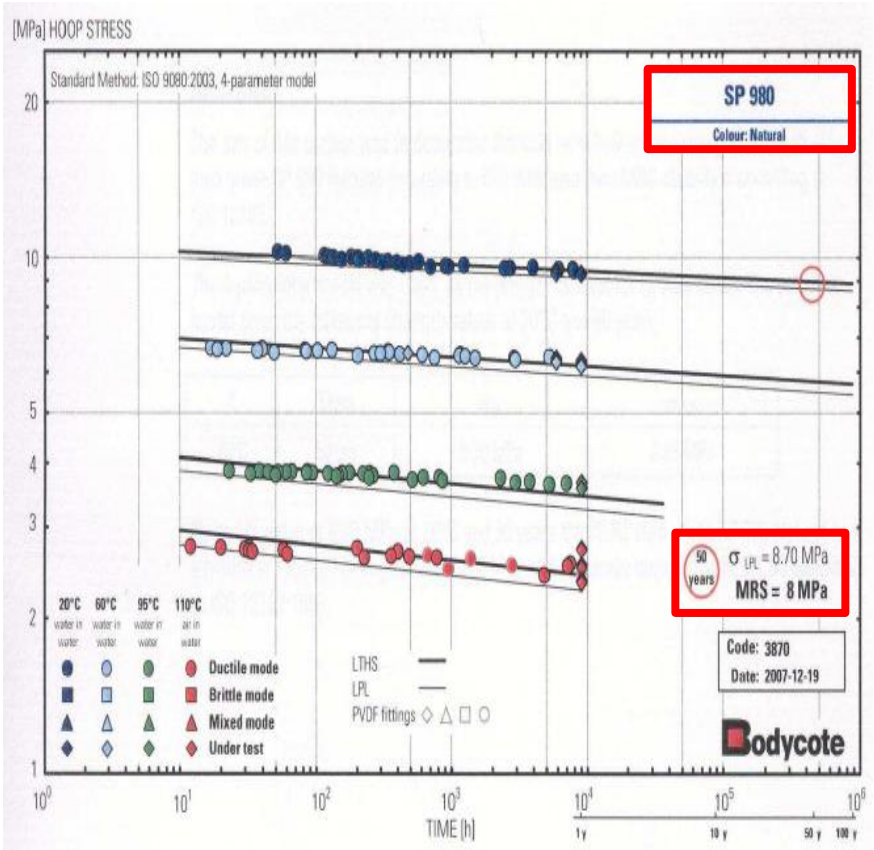


It makes a excellent LTHS at high temp.

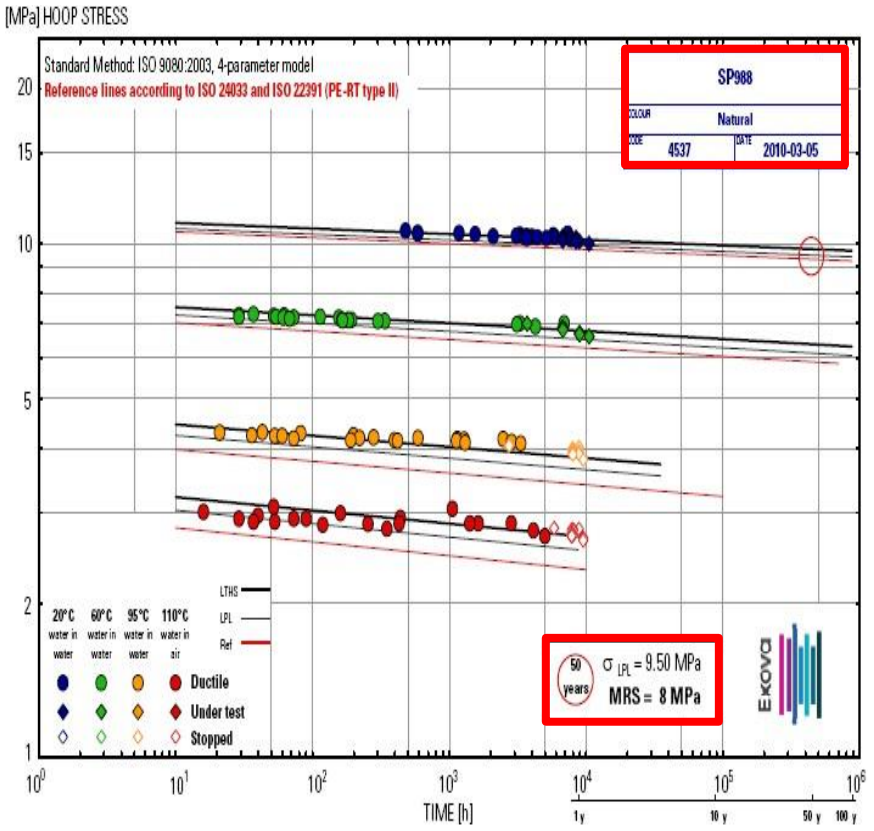
LG PE-RT Characteristics

2) Outstanding Long-Term Hydrostatic strength (MRS Certi.)

LG PE-RT Type I SP980



LG PE-RT Type II SP980

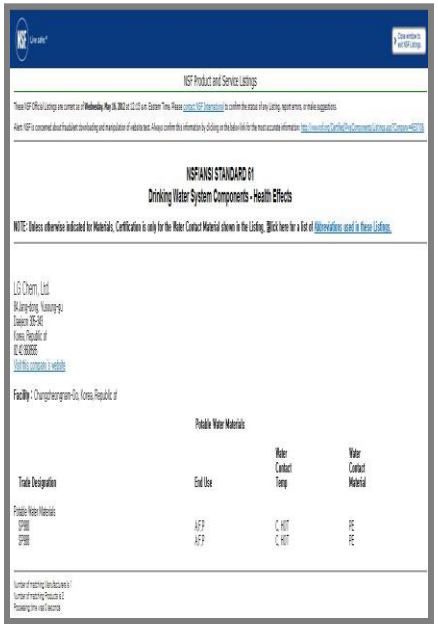


LG PE-RT meet the requirements of reference lines by ISO 24033 & 22391-2.

LG PE-RT Characteristics

3) Satisfying sanitation standards for drinking water

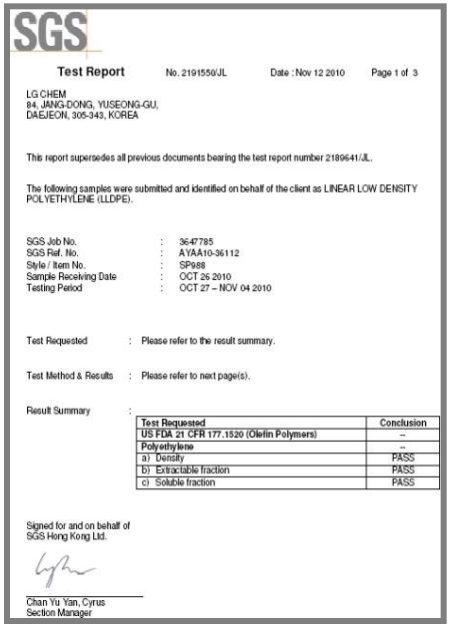
- NSF ANSI 61 (Drinking Water System component)
- FDA regulation 21 CFR 177.1520
- KTW, DVGW W270 (Germany, Portable water pipe certification)



NSF Product and Service Listings

NSF/ANSI STANDARD 61

Drinking Water System Components - Health Effects



SGS

Test Report No. 2191550/JL Date : Nov 12 2010 Page 1 of 3

LG CHEM
84, JANG-DONG, YUSEONG-GU,
DAEJEON, 305-343, KOREA

This report supersedes all previous documents bearing the test report number 2189641/JL.

The following samples were submitted and identified on behalf of the client as LINEAR LOW DENSITY POLYETHYLENE (LLDPE).

SGS Job No.	:	3647785
SGS Ref. No.	:	AYAA10-36112
Style / Item No.	:	SP988
Sample Receiving Date	:	OCT 26 2010
Testing Period	:	OCT 27 – NOV 04 2010

Test Requested : Please refer to the result summary.

Test Method & Results : Please refer to next page(s).

Result Summary :

Test Requested	Conclusion
US FDA 21 CFR 177.1520 (Olefin Polymers)	--
Polyethylene	--
a) Density	PASS
b) Extractable fraction	PASS
c) Soluble fraction	PASS

Signed for and on behalf of
SGS Hong Kong Ltd.

Chan Yu Yan, Cyrus
Section Manager

TZW
Prüfstelle Wasser

LG Chem. Ltd.
Tech Center, Polyolefin Team
Mr. Joseph (nakkyu) Song
175, Gajeong-ro, Yuseong-Gu,
305-343 DAEJEON
KOREA

19.11.2014

Test according to DVGW-Standard W 270 (11/2007) of the material Lucene SP988 - your order 18.04.2014

Dear Mr. Song,

we have finished the tests according to DVGW-worksheet W 270 (11/2007) of the material Lucene SP988. Because of the positive test results a test certificate can be issued in which the valid range of use is given.

Please find attached the test certificate and additionally our invoice.

Best regards

TECHNOLOGIEZENTRUM WASSER
PRÜFSTELLE WASSER

Dr. J. Klinger / i.A. Dr.-Ing. R. Turkovic
Head of the Test Centre

TZW
Prüfstelle Wasser

PRÜFZEUGNIS

über die Untersuchung von Werkstoff "Lucene SP988" gemäß der KTW-Leitlinie des Umweltbundesamtes (UBA)

Hersteller: LG Chem. Ltd., 305-343 Daejeon, Korea
Art der Probe: PE-RT Qualität
Bezeichnung der Probe: Werkstoff "Lucene SP988"
Art der Prüfcharge: gelieferte Probeplatten
Eingang der Probe: 05.05.2014
Probenehmer: Auftraggeber
TZW-Az.: KA 0192/14

Untersuchungsergebnisse

1. Rezeptur: wurde unter KC 253/14 vorgelegt und überprüft
2. Migrationstest:

Kaltwasser 23°C	1. – 3. Tag	4. – 6. Tag	7. – 9. Tag	Richtwert für 3. Extraktion
Klarheit, Färbung, Geruch, Geschmack, Schaumbildung	nmb	nmb	nmb	nicht nennenswert beeinflusst
C-Abgabe [mg C/m²d]	<0,3	<0,3	<0,3	≤ 12,5

HeiSwasser 85°C	1. Extr.	2. Extr.	3. Extr.	6. Extr.	7. Extr.	Richtwert für 7. Extr.
Klarheit, Färbung, Geruch, Geschmack, Schaumbildung	nmb	nmb	nmb	nmb	nmb	≤ 4
C-Abgabe [mg C/m²d]	5,8	5,2	4,2	2,3	1,9	≤ 12,5
6 Rezepturbestandteile, die der Geheimhaltung unterliegen	Richtwert eingehalten					Trinkwasser-SML-Werte nach BedarfsgegenständeV

Die untersuchten Proben Werkstoff "Lucene SP988" für den Kontakt mit Trinkwasser entsprechen den Anforderungen der KTW-Leitlinie des Umweltbundesamtes (UBA) (Bundesgesundheitsblatt aktuelle Fassung) im Bereich Auslaugungsgegenstände.

Anmerkung:
Die Gültigkeit dieses Prüfzeugnisses richtet sich nach anderen festgelegten Bestimmungen. Sie endet jedoch spätestens 5 Jahre nach Ausstellungsdatum.
Für eine Verlängerung gelten gesonderte Bestimmungen.

Karlsruhe, den 04.12.2014

Dr. J. Klinger / i.A. Dr.-Ing. R. Turkovic
Leiter der Prüfstelle

4) LG PE-RT pipe can be connected by a variety of connect methods

① Connect method

Heat fusion

Socket

Push-fit (One-touch)

② Successfully uses injection-molded fittings

※ PE-RT(SP988) Injection fitting test (Push – Fit Type)

- Test Results
  - ① Thermal cycling test (5,000cycle) : Pass
  - ② Pull out test (High Temperature) : Pass
  - ③ Pull out test (Low Temp.) : Pass
  - ④ Vacuum test : Pass

LG PE-RT Grades

※Technical Data Sheet

Properties	Unit	Test Method	SP980	SP988
PE-RT Classification			Type I	Type II
Physical Property				
Melt Index	g/10min	ASTM D1238	0.6	0.6
Density	g/㎤	ASTM D1505	0.938	0.941
Softening Point(Vicat)	℃	ASTM D1525	124	125
Mechanical Property				
Tensile Strength at Yield	kg/㎠	ASTM D638	190	210
Tensile Strength at Break	kg/㎠	ASTM D638	350	370
Elongation at Break	%	ASTM D638	>700	>700
Izod Impact Strength	kg·cm/cm	ASTM D256	N.B	N.B
Flexural Modulus	kg/㎠	ASTM D790	5,700	6,500
Hardness(Shore D)	-	ASTM D2240	55	57
E.S.C.R(F50)	hr	ASTM D1693	> 10,000	> 10,000

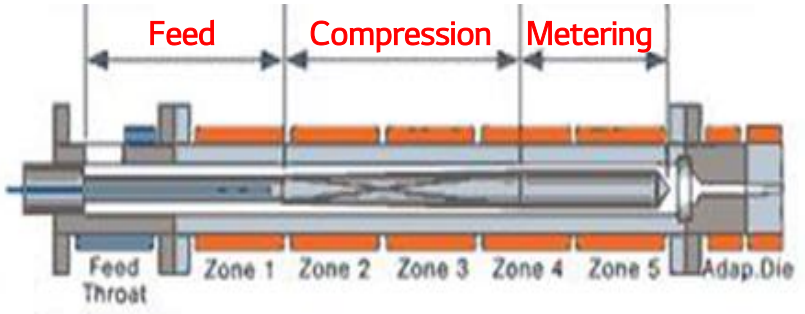
LG PE-RT Processing Conditions

1) Equipment

- Single Screw Extruder (Conventional PE Screw)
- Recommendation : Screw C/R = 2.2 ~ 2.5
  Screw L/D = 24 ~ 30
  Die Gap = Wall thickness X 1.7 ~ 2.5

2) Temperature Profile

- Hopper Zone = Cooled
- Cylinder(Barrel) Zone = 170 ~ 230 ℃
- Head / Dies Zone = 220 ~ 230 ℃



3) Die to Calibration

- To reach high extrusion speed, the distance between the die and the calibration should be 2~10 cm

4) Water spray is necessary to prevent the adhesion between calibration unit and pipes.

LG PE-RT Packaging & Loading

25KG PP Woven Bag			500KG Flecon Bag		Sea-Bulk
Palletized		Loose Bag	Two Bags on one Pallet		One Liner
20ft	40ft	20ft	20ft	40ft	20ft
14 MT	22 MT	17.6 MT	10 MT	22 MT	17 MT (±10%)