TEST REPORT NO: 198911

Date: 21 May 2024

PORTWEST UC
IDA BUSINESS PARK
WESTPORT
CO MAYO
F28 FY88
REPUBLIC OF IRELAND

The following sample(s) was/were submitted and identified by/on behalf of the client as:

Retailer	PPE Testing
Description of article	ARAFLAME 93% META ARAMID, 5% PARA ARAMID, 2% CARBON FIBRE 150G
Retailer style number	NAVY
Retailer Standard Number	FABRIC USED IN FR GARMENTS
Order No./ Buyer	ARAFLAME
Quality/Fibre Composition	93% META ARAMID, 5% PARA ARAMID, 2% CARBON FIBRE 150G
Date Sample Received/Test Started:	09 May 2024

Tests	Remarks
ASTM D2863-2023 Plastics - Determination of burning behaviour by oxygen index	See results

Signature

M. Harrison

M. Harrison Laboratory Manager

For and on behalf of
SGS United Kingdom Ltd

All samples are conditioned to ISO 139 where conditioning is required (unless otherwise stated)

Customer: **PORTWEST UC** **Test Report No:** **198911**

Test Results

I. Test Conducted

This test is conducted accordance with ASTM D 2863-2023 Standard Test Method for Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index).

II. Sample Descriptions

Sample description	ARAFLAME COVERALL (Provided by client)
Color	Navy
Density	About 151 g/m^2
Size of sample	Length 140mm; Width 52mm; Thickness 0.4mm

Conditioning	Temperature	RH	Duration
Precondition	23±2°C	50±5%	≥40h
Test condition	23±2°C	50±5%	--

Test specimen type	V
Ignition method	Propagation ignition
Flow rate in column	40mm/s at temperature 23±2°C, lasting time≥30s
Test procedure	Procedure B

III. Test results

Lengthwise

1) Select initial oxygen concentration (in accordance with11.1.1): 27% (V/V)

2) Determining the Preliminary Oxygen Concentration (Till pair of oxygen concentrations which gives opposite response differs by ≤1%, in accordance with 11.1.10)

Oxygen concentration, %	27	23	25	26		
Length burnt, mm	>80	5	8	>80		
Response, “X” or “O”	X	O	O	X		

Oxygen concentration of the “O” response for the pair = 25.0% (this is the concentration to be used again for the first measurement in section below)

Customer: **PORTWEST UC** **Test Report No:** **198911**

Test Results

3) Determination of the oxygen index (in accordance with 11.1.11)

Step size to be used for successive changes d in oxygen concentration = 0.2% [Initially to be 0.2% (V/V), unless otherwise instructed]

N_T series measurements											
Parameter	**N_L series measurements (11.1.11.1+11.1.11.2)**						**(11.1.11.3)**				**C_f**
Oxygen concentration, % (V/V)	25.0	25.2	25.4	25.6	-	-	25.6	25.4	25.6	25.8	25.6
Length burnt, mm	7	8	12	>80	-	-	>80	17	52	>80	>80
Response, “X” or “O”	O	O	O	X	-	-	X	O	O	X	X
Column (2, 3, 4 or 5): 4							Row (1 to 16): 4				
k value from table below: -0.14											
Hence k = -0.14											

OI = C_f + kd = 25.6+(-0.14)×0.2

=25.5% (to one decimal place, for reporting OI)

=25.57% (to two decimal places, for calculation of and verification of d as required)

Customer: **PORTWEST UC** **Test Report No:** **198911**

Test Results

4) Determination of K value

1	2	3	4	5	6
Responses for the last five measurements	Values of k for which the first NL determinations are				
	a)O	OO	OOO	OOOO	
XOOOO	-0.55	-0.55	-0.55	-0.55	OXXXX
XOOOX	-1.25	-1.25	-1.25	-1.25	OXXXO
XOOXO	0.37	0.38	0.38	0.38	OXXOX
XOOXX	-0.17	-0.14	-0.14	-0.14	OXXOO
XOXOO	0.02	0.04	0.04	0.04	OXOXX
XOXOX	-0.50	-0.46	-0.45	-0.45	OXOXO
XOXXO	1.17	1.24	1.25	1.25	OXOOX
XOXXX	0.61	0.73	0.76	0.76	OXOOO
XXOOO	-0.30	-0.27	-0.26	-0.26	OOXXX
XXOOX	-0.83	-0.76	-0.75	-0.75	OOXXO
XXOXO	0.83	0.94	0.95	0.95	OOXOX
XXOXX	0.30	0.46	0.50	0.50	OOXOO
XXXOO	0.50	0.65	0.68	0.68	OOOXX
XXXOX	-0.04	0.19	0.24	0.25	OOOXO
XXXXO	1.60	1.92	2.00	2.01	OOOOX
XXXXX	0.89	1.33	1.47	1.50	OOOOO
	Values of k for which the first NL determinations are				Responses for the last five measurements
	X	XX	XXX	XXXX b)	
	Are as given in the above table opposite the appropriate response in column6 a, but with the sign of k reversed i.e. OI=Cf-kd (see 9.1)				

Customer: **PORTWEST UC** **Test Report No:** **198911**

Test Results

5) Verification of step size d % oxygen concentration (in accordance with 11.1.11.6 and 12.3)

Last six results	Oxygen concentration, % (V/V)			
	Ci[a]	OI	Ci – OI	$(Ci - OI)^2$
Cf 1	25.6	25.57	0.03	0.0009
2	25.8	25.57	0.23	0.0529
3	25.6	25.57	0.03	0.0009
4	25.4	25.57	-0.17	0.0289
5	25.6	25.57	0.03	0.0009
n 6	25.4	25.57	-0.17	0.0289
Total $\sum(Ci - OI)^2$				0.1134
a Column Ci contains the oxygen concentrations used for the measurements of C_f and for each of the 5 preceding measurements, for n = 6				

Estimation of standard deviation:

If $2\sigma^*/3<d<3\sigma^*/2$ or $0.2=d>3\sigma^*/2$, the OI is valid.

$\sigma^*=[\sum(Ci - OI)^2 / (n-1)]^{(1/2)}= 0.151$

$2\sigma^*/3= 0.100$

$3\sigma^*/2=0.226$

Since d is in the acceptable range, OI is valid.

In our opinion, the Oxygen Index (OI) of the submitted sample is 25.5%(V/V).

Widthwise

1) Select initial oxygen concentration (in accordance with11.1.1): 26% (V/V)

2) Determining the Preliminary Oxygen Concentration (Till pair of oxygen concentrations which gives opposite response differs by ≤1%, in accordance with 11.1.10)

Oxygen concentration, %	26	25		
Length burnt, mm	>80	12		
Response, “X” or “O”	X	O		

Oxygen concentration of the “O” response for the pair = 25.0% (this is the concentration to be used again for the first measurement in section below)

3) Determination of the oxygen index (in accordance with 11.1.11)

Step size to be used for successive changes d in oxygen concentration = 0.2% [Initially to be 0.2% (V/V), unless otherwise instructed]

Customer: **PORTWEST UC** **Test Report No:** **198911**

Test Results

N_T series measurements											
Parameter	**N_L series measurements (11.1.11.1+11.1.11.2)**						**(11.1.11.3)**				**C_f**
Oxygen concentration, % (V/V)	25.0	25.2	25.4	-	-	-	25.4	25.2	25.4	25.2	25.4
Length burnt, mm	15	28	>80	-	-	-	>80	17	>80	34	>80
Response, “X” or “O”	O	O	X	-	-	-	X	O	X	O	X
Column (2, 3, 4 or 5): 3							Row (1 to 16): 6				
k value from table below: -0.46											
Hence k = -0.46											

OI = C_f + kd = 25.4+(-0.46)×0.2

=25.3% (to one decimal place, for reporting OI)

=25.31% (to two decimal places, for calculation of and verification of d as required)

Customer: **PORTWEST UC** **Test Report No:** **198911**

Test Results

4) Determination of K value

1	2	3	4	5	6
Responses for the last five measurements	Values of k for which the first NL determinations are				
	a)O	OO	OOO	OOOO	
XOOOO	-0.55	-0.55	-0.55	-0.55	OXXXX
XOOOX	-1.25	-1.25	-1.25	-1.25	OXXXO
XOOXO	0.37	0.38	0.38	0.38	OXXOX
XOOXX	-0.17	-0.14	-0.14	-0.14	OXXOO
XOXOO	0.02	0.04	0.04	0.04	OXOXX
XOXOX	-0.50	-0.46	-0.45	-0.45	OXOXO
XOXXO	1.17	1.24	1.25	1.25	OXOOX
XOXXX	0.61	0.73	0.76	0.76	OXOOO
XXOOO	-0.30	-0.27	-0.26	-0.26	OOXXX
XXOOX	-0.83	-0.76	-0.75	-0.75	OOXXO
XXOXO	0.83	0.94	0.95	0.95	OOXOX
XXOXX	0.30	0.46	0.50	0.50	OOXOO
XXXOO	0.50	0.65	0.68	0.68	OOOXX
XXXOX	-0.04	0.19	0.24	0.25	OOOXO
XXXXO	1.60	1.92	2.00	2.01	OOOOX
XXXXX	0.89	1.33	1.47	1.50	OOOOO
	Values of k for which the first NL determinations are				Responses for the last five measurements
	X	XX	XXX	XXXX b)	
	Are as given in the above table opposite the appropriate response in column6 a, but with the sign of k reversed i.e. OI=Cf-kd (see 9.1)				

5) Verification of step size d % oxygen concentration (in accordance with 11.1.11.6 and 12.3)

Last six results	Oxygen concentration, % (V/V)			
	Ci^a	OI	Ci – OI	$(Ci – OI)^2$
Cf 1	25.4	25.31	0.09	0.0081
2	25.2	25.31	-0.11	0.0121
3	25.4	25.31	0.09	0.0081
4	25.2	25.31	-0.11	0.0121
5	25.4	25.31	0.09	0.0081
n 6	25.2	25.31	-0.11	0.0121
Total $\sum(Ci – OI)^2$				0.0606
a Column Ci contains the oxygen concentrations used for the measurements of C_f and for each of the 5 preceding measurements, for n = 6				

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Test Results

Estimation of standard deviation:

If $2\sigma^*/3<d<3\sigma^*/2$ or $0.2=d>3\sigma^*/2$, the OI is valid.

$\sigma^*=[\sum(Ci - OI)^2 / (n-1)]^{(1/2)}= 0.110$

$2\sigma^*/3= 0.073$

$3\sigma^*/2=0.165$

Since d is in the acceptable range, OI is valid.

In our opinion, the Oxygen Index (OI) of the submitted sample is 25.3%(V/V).

*Sub-contracted to a SGS laboratory

End of Report