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RESEARCH DEVELOPMENT FIRE BLANKET

Aventi

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Abstract

Research development fire blanket is a follow-up study from previous researchers.

This research is intended to obtain fire blankets from best fabric, using best chemicals, which are widely available on market and very easy to get on market, so that general public can easily obtain fabric and chemicals used for development this fire blanket in community.

This study uses ten types of fabric, three types of fire retardant chemicals, and three types of preservative chemicals, so that fire blanket fabric according to its function can inhibit spread of fire / extinguish fire in event of fire, and not quickly damaged / torn /decay eaten by insects.

The fabric of fire blanket is included in class 2, which is somewhat resistant to fire /rather non-flammable, under class 1 which is completely non-flammable, namely fabric two sides blue with mixture 6 C and mixture 2 C. Fabricantifire from Korea with mixture 2 C. Fabric jeans, corduroy, two sides red, and body rock, all with mixture 6 C.

Other fabrics include grade 3, which is resistant to fire under grade 2.

Keywords

Fire Blanket, Fabric, Chemical

1. Introduction

The first researcher who did the research on fire blanket was Drs. Ahmad HidayatEfendi and the team from Staff Building Science Division, conducted in state expenditure budget (APBN) activities in 2003 "Implementation of the Early Fire Extinguishing System Using Tools for the Performance of Sprinklers and Fire Blankets".

The results of the study: (1) The effect of fire retardant and the thickness of the fire blanket based on evaluation of fire propagation on the surface of fire blanket, has been shown to reduce the length of fire propagation. For thickness 0.08 mm around 93.86 % and thickness 0.74 mm around 94.17 %; (2) Burning fire blanket with the cooking oil fire test method proves that fire blanket with thickness 0.08 mm and 0.74 mm, both without soaking and soaking with fire retardant, after being burned for 30 minutes with temperature 320 °C the oil does not burn or does not ignite. The effect of thickness and use of fire retardants can reduce temperature of fire blankets between 4.00% until 6.13%.

In 2015 APBN activity, 1000 fire blankets were made by the APBN Activities with coordinator ArifSetiawan, ST. MT, and the research team of Building Management Division (now Building Science Division). The fire blanket made in 2015 used same type of fabric as type of fabric used in 2003, and the chemicals used in the manufacture of fire blankets in 2015 used same chemicals as the chemicals used in 2003.

The innovation research that we will do is to continue the research on fire blankets that were carried out in 2003 and 2015.

2. Methodology

The initial step is to cut the fabric for fire blanket, measuring 20 cm x 20 cm.

This is intended to obtain a type of fabric that can be used as fire blanket; and to obtain the types of chemicals, as well as the composition of chemicals, which can be used as materials for making fire blankets.

Fabrics are chosen randomly by researchers, based on the type of fabric that is considered appropriate as fire blankets, interviews, and market surveys to cloth traders, including fabric: (a) body rock ; (b) corduroy ; (c) anti fire Korea ; (d) two sides red ; (e) two sides blue ; (f)oscar black ; (g) oscar orange ; (h) mesh ; (i) jeans ; (j) antiskid green ; (k) antiskid white.

The process of mixing and soaking using chemicals is as follows:

- Code 1: soak 31 July 2018 = 1 salt : 3 MAP (*mono ammonium phosphate*) = 150 gram salt : 450 gram MAP.

- Code 2: soak 7 August 2018 = 1 *sodium benzoate*: 3 *potassium carbonate* = 150 gram *sodium benzoate*: 450 gram *potassium carbonate*.
- Code 3: soak 4 September 2018 = 1 *sodium nitrate*: 3 *ethylene glycol* = 150 gram *sodium nitrate*: 450 gram *ethylene glycol*.
- Code 4: soak 14 September 2018 = 2 salt: 4 *ethylene glycol* = 300 gram salt : 600 gram *ethylene glycol*.
- Code 5: soak 20 September 2018 = 2 *sodium nitrate*: 4 *potassium carbonate* = 300 gram *sodium nitrate*: 600 gram *potassium carbonate*.
- Code 6: soak 26 September 2018 = 2 *Sodium benzoate*: 4 MAP = 300 gram *sodium benzoate*: 600 gram MAP.
- Code 7: soak 12 October 2018 = 3 salt: 5 *potassium carbonate* = 450 gram salt: 750 gram *potassium carbonate*.
- Code 8: soak 19 October 2018 = 3 *sodium benzoate*: 5 *ethylene glycol* = 450 gram *sodium benzoate*: 750 gram *ethylene glycol*.
- Code 9: soak 26 October 2018 = 3 *sodium nitrate*: 5 MAP = 450 gram *sodium nitrate*; 750 gram MAP.
- Treatment for code 1 – 9: soak 1 day (A); soak 2 day (B); soak 3 day (C).

This research use chemicals: (a) *Ethylene glycol* = fire resistant; (b) *Potassium carbonate / salt of tartar* = fire resistant; (c) *Mono ammonium phosphate* (MAP) = fire extinguisher; (d) *Sodium nitrate* = preservative; (e) *Sodium benzoate* = preservative; (f) Salt = preservative.

After cutting the fire blanket fabric, researcher conducted boiled test on all variations of fire blanket fabric. The entire fabric of the fire blanket withstands the boiled test for three hours, without tearing, breaking, or melting. Researchers have not been able to analyze further the results of the boiled test, because researchers still have not found the appropriate literature/standard for testing boiled fire blankets. But if the fire blanket fabric variations above are used in areas with 100°C boiling water, it will be safe for three hours.

Researcher conducted a fire propagation test, using a fire propagation test tool, and it was just done on a fire blanket with code 1 C, 2 C (partially), 3 C, 4 C, 6 C, 8 C, and 9 C, which was soaked with chemical for three days. Whereas for code 5 C and 7 C, researchers have not had time to do it, it is constrained that the fire propagation test equipment will not turn on. Also for

fire blankets which were soaked for one and two days, had not yet been done, constrained by fire propagation test equipment that would not turn on.

Test results of fire propagation of fire blanket fabric attached. The temperature of the fire blanket fabric is detected by thermocouple.

3. Literature Study

Heat moves from objects or high-temperature systems to objects or low-temperature systems. There are three ways for heat to move from one object to another, namely conduction, convection, radiation (AnisM.S, et.al, 2005).

Conduction is heat transfer that is not accompanied by transfer of conductor. Based on its ease of ability to transfer heat, substances can be divided into : conductors that are easy to transfer heat and insulators which are more difficult in transfer heat(AnisM.S, et.al, 2005).

Examples of conductors are aluminum, metal, etc., while examples of insulators are plastic, wood, fabric, etc. Examples of conduction transfers such as heated iron(AnisM.S, et.al, 2005).

Fire Blanket is one of the tools used to extinguish the fire. Fire blanket is a blanket /fabric made of special fabric used to extinguish fire by covering fire. Fire blankets are commonly used for people who are trapped in a fire and their bodies are burned, so for extinguish fires on someone's body used fire blanket (Budiman, 2016).

Fire blankets have the same function as gunny sacks. In a fire incident if ever see firefighter putting out fire using gunny sack dipped in water first, the function of fire blanket is more or less like that. At this time gunny sacks have been hard to find, so for fire equipment firefighters is used fire blanket (Budiman, 2016).

The price of fire blankets is far more expensive than the price of gunny sacks even though each has the same function. It is recommended to use fire blanket because it is made of special fabric and is easy to get and how to use it is quite simple(Budiman, 2016).

Corduroy is a type of textile fabric made of thick cotton fiber that is twisted, has a good and smooth texture. This fabric consists of a tufted strap that will look like a channel shaped along lines along the fabric. The type of corduroy is usually used to make sweaters, women's blazers, trousers, and children's jackets (Dana Vincent, 2016).

Currently denim /jeans are not only used to make jeans. Many also use it to make jackets, vests, hats, or blazers. The style that is quite unique makes this type of fabric liked by many

people. The texture also varies, some are soft and rough, not too flexible, and strong(Dana Vincent, 2016).

Temperature is a thermodynamic unit that shows kinetic energy of average translation of molecules in gas system ; temperature is measured by using a thermometer (DewiPuspita, 2018).

Temperature indicates degree of heat objects. Easily, the higher temperature of an object, the hotter the object will be. Microscopically, temperature shows energy possessed by an object. Each atom in object each moves, both in the form of displacement and movement in the form of vibration. The higher energy atoms making up object, the higher temperature of object(DewiPuspita, 2018).

Temperature is usually defined as size or degree of heat of an object or system. Hot objects have high temperatures, while cold objects have low temperatures. In its binding, temperature is a measure of average kinetic energy possessed by molecules of an object(DewiPuspita, 2018).

Fabric oscar is a synthetic fabric that has a structure and shape resembling leather. Physically, the appearance of fabric oscar which is usually used as a foam coating on the back of the spring bed, sofa, chair, and car seat is very similar to genuine leather. But the price is relatively affordable and has an appeal. Its soft and strong nature makes fabric oscar a comfortable and durable coating material if cared for in the right way (Fintline, 2015).

Fabric oscar is included in the type of fabric that is waterproof, therefore to clean the dust that sticks to the surface simply use a cloth that is rather wet. When exposed to sauce or coffee spills as much as possible, immediately clean the fabric oscar by wiping it. Because stains that have dried will be more difficult to clean(Fintline, 2015).

If the stain is from ink or paint, use special cleaner vinyl. Avoid using detergent, alcohol, thinner, shampoo or similar fluids because it can damage the surface of fabric oscar. In order to maintain the color and the structure of the fabric, try to hang the sofa covered with fabric oscar in certain location that is protected from direct sunlight(Fintline, 2015).

Besides being used for sofa linings, fabric oscar also used by designers to make backpacks, camera bags and distro bags(Fintline, 2015).

Fabric mesh is included in fabric type that have large porous like fabric tile. Fabric mesh has very unique appearance because it is composed of woven threads that are loosely woven so as to produce fabric that has regular holes resembling nets. Fabric mesh used as coating for inside jacket as well as complementary to various other purposes(Fintline, 2017, January 19).

Fabric mesh has a shape like a net or mesh. Fabric mesh can be made from cotton fibers, synthetic polyester fibers or other fabric fibers(Fintline, 2017, January 19).

Based on design and purpose of use, fabric mesh is grouped into several types of variants with different levels of fabric thickness, which is fabric mesh for furring, fabric double mess for hats, fabric mesh for variation bags (Fintline, 2017, January 24).

Kalii carbonate or Salt of tartar, hygroscopic powder /granular form with melting point is 891°C. There are also not hygroscopic, that is type sesquihydrate. Used in industry soap, glass, ceramic, and tanning leather. In cosmetics as liquid shampoo ingredients (Hemi RatnaSari, 2015).

4. Test Result

Flame Spread Rating that has been accepted generally based on method ASTM E84 using large size sample. Test Method ASTM D3806 used in this test provides a value of the relative fire propagation rate using small size sample. The results obtained from this test are only indicative of the result obtained with large sample on testing using ASTM E84. Fire propagation rate approximated by equation:

$$y = 4,8 + 0,92x \quad (1)$$

With x is the result obtained by testing the 2-foot flame tunnel, and y is prediction rating when using tunnel E84.

Test use equipment *2-foot flame tunnel* consisting of an *angle-iron flamemeasuring* 60 cm x 10 cm (24 inch x 4 inch) with slope 28° horizontal position. The side and ignition is closed with cement asbestos board thick 6 mm (1/4 inch). Hot air, gas, and smoke generated will be flowed in tunnel and thrown through the chimney at the end.

Table 1: Specifications

No	Fabric	Weight (gram/cm ²)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	65	-	65	70	50	40	50
2	Corduroy	60	-	55	60	60	65	66
3	Body Rock	50	50	50	45	50	42	50
4	Two Sides Red	15	25	15	15	20	20	30

No	Fabric	Weight (gram/cm ²)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
5	Two Sides Blue	35	32	40	50	35	32	50
6	Oscar Black	40	43	40	45	-	42	60
7	Anti Fire Korea	25	30	-	-	0	-	-
8	Oscar Orange	-	-	75	85	100	85	90
9	Antiskid Green	70	-	70	70	80	65	80
10	Antiskid White	45	40	35	35	50	35	40
11	Mesh	75	-	80	75	60	85	85

4.1 Data Test and Calibration

Data calibration used are data test red oak wood and flat sheets fiber cement. Test results are showed in Table 2.

Table 2: Calibration Results

	Red Oak Wood *	Fiber Cement Sheet**
Flame length(L), inch	13	0
Constants FS (k)		
= $100 / (L_o - L_a) = 100 / (13 - 0) = 7.7$		
Explanation : * thick 3 mm ** thick 6 mm		

Table 3: Test Results and Calibration 2-foot flame tunnel

No	Fabric	Flame Length(L), inch						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	17	-	22	22	6	22	8
2	Corduroy	10	-	11	19	6	22	8
3	Body Rock	8	13	22	22	8,5	13	9
4	Two Sides Red	6,5	13	13	12	6	22	22
5	Two Sides Blue	10	5,5	22	13	4	22	22
6	Oscar Black	12	22	22	22	-	22	22
7	Anti Fire Korea	10	6	-	-	-	-	-
8	Oscar Orange	-	-	22	22	22	22	22

No	Fabric	Flame Length(L), inch						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
9	Antiskid Green	22	-	22	22	22	22	22
10	Antiskid White	22	15	15	22	16	22	22
11	Mesh	16	-	22	22	22	22	22

Table 4: Evaluation Data

No	Fabric	2-foot tunnel flame spread rating (FS x k)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	131	-	169	169	46	169	62
2	Corduroy	77	-	85	146	46	169	62
3	Body Rock	62	100	169	169	66	100	69
4	Two Sides Red	50	100	100	92	46	169	169
5	Two Sides Blue	77	42	169	100	31	169	169
6	Oscar Black	92	169	169	169	-	169	169
7	Anti-Fire Korea	77	46	-	-	-	-	-
8	Oscar Orange	-	-	169	169	169	169	169
9	Antiskid Green	169	-	169	169	169	169	169
10	Antiskid White	169	116	116	169	123	169	169
11	Mesh	123	-	169	169	169	169	169

Table 4: Evaluation Data (continue)

No	Fabric	Prediction FS Value E84						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	125.3	-	160.3	160.3	47.1	160.3	61.8
2	Corduroy	75.6	-	83	139.1	47.1	160.3	61.8
3	Body Rock	61.8	96.8	160.3	160.3	65.5	96.8	68.3
4	Two Sides Red	50.8	96.8	96.8	89.4	47.1	160.3	160.3
5	Two Sides Blue	75.6	43.4	160.3	96.8	33.3	160.3	160.3
6	Oscar Black	89.4	160.3	160.3	160.3	-	160.3	160.3
7	Anti Fire Korea	75.6	47.1	-	-	-	-	-

No	Fabric	Prediction FS Value E84						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
8	Oscar Orange	-	-	160.3	160.3	160.3	160.3	160.3
9	Antiskid Green	160.3	-	160.3	160.3	160.3	160.3	160.3
10	Antiskid White	160.3	111.5	111.5	160.3	118	160.3	160.3
11	Mesh	118	-	160.3	160.3	160.3	160.3	160.3

4.2 Additional Data

Table 5: Amount of Burned Fabric

No	Fabric	Initial Weight (gram)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	65	-	65	70	50	40	50
2	Corduroy	60	-	55	60	60	65	66
3	Body Rock	50	50	50	45	50	42	50
4	Two Sides Red	15	25	15	15	20	20	30
5	Two Sides Blue	35	32	40	50	35	32	50
6	Oscar Black	40	43	40	45	-	42	60
7	Anti Fire Korea	25	30	-	-	0	-	-
8	Oscar Orange	-	-	75	85	100	85	90
9	Antiskid Green	70	-	70	70	80	65	80
10	Antiskid White	45	40	35	35	50	35	40
11	Mesh	75	-	80	75	60	85	85

Table 5: Amount of Burned Fabric (continue)

No	Fabric	Final Weight (gram)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	50	-	25	50	40	12	35
2	Corduroy	40	-	15	25	50	20	60
3	Body Rock	35	15	20	15	40	20	35
4	Two Sides Red	12	15	10	10	15	15	15
5	Two Sides Blue	25	30	30	35	30	25	30
6	Oscar Black	30	30	30	25	-	30	45

No	Fabric	Final Weight (gram)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
7	Anti Fire Korea	15	20	-	-	-	-	-
8	Oscar Orange	-	-	40	70	35	45	35
9	Antiskid Green	50	-	40	45	30	27	25
10	Antiskid White	25	12	22	15	20	17	15
11	Mesh	45	-	30	45	50	40	60

Table 5: Amount of Burned Fabric (continue)

No	Fabric	Percentage of Fabric that is Burning (%)						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	23	-	62	29	20	70	30
2	Corduroy	33	-	73	58	17	69	9
3	Body Rock	30	70	60	67	20	52	30
4	Two Sides Red	20	40	33	33	25	25	50
5	Two Sides Blue	29	6	25	30	14	22	40
6	Oscar Black	25	30	25	44	-	29	25
7	Anti Fire Korea	40	33	-	-	-	-	-
8	Oscar Orange	-	-	47	18	65	47	61
9	Antiskid Green	29	-	43	36	63	58	69
10	Antiskid White	44	70	37	57	60	51	63
11	Mesh	40	-	63	40	17	53	29

4.3 Data Fire Propagation

Table 6: Code 1C, 7 December 2018

Time (Second)	Fire Propagation Temperature (°C)									
	Jeans	Corduroy	Body Rock	Two Sides Red	Two Sides Blue	Oscar Black	Anti Fire Korea	Antiskid Green	Antiskid White	Mesh
0	27.9	28.4	28.0	28.5	27.9	28.4	28.1	28.0	28.5	27.7
15	28.0	28.4	28.3	28.1	27.8	28.6	27.9	28.2	28.3	27.6
30	28.0	28.0	28.2	28.5	27.7	28.0	28.2	27.7	28.4	27.6
45	28.3	28.0	28.5	28.9	28.2	28.1	27.7	27.9	28.2	27.6

Time (Second)	Fire Propagation Temperature (°C)									
	<i>Jeans</i>	<i>Corduroy</i>	<i>Body Rock</i>	<i>Two Sides Red</i>	<i>Two Sides Blue</i>	<i>Oscar Black</i>	<i>Anti Fire Korea</i>	<i>Antiskid Green</i>	<i>Antiskid White</i>	<i>Mesh</i>
60	28.2	28.2	28.4	28.2	27.8	28.2	27.9	27.7	27.7	27.7
75	28.0	28.0	28.0	28.5	28.1	27.6	28.5	27.4	28.4	27.6
90	28.0	27.9	28.3	28.5	28.3	27.8	27.6	28.1	28.5	27.3
105	28.2	28.2	28.3	28.0	27.5	28.1	27.6	28.1	28.7	27.6
120	28.0	28.5	27.8	28.2	28.1	27.7	28.1	27.5	28.9	27.6
135	28.1	27.9	28.1	28.7	28.0	27.9	27.3	27.9	28.5	27.7
150	27.7	28.0	28.2	28.6	28.3	28.3	27.7	27.8	28.9	27.8
165	28.0	28.2	28.0	28.0	27.9	28.4	28.1	28.4	28.5	27.4
180	28.5	27.8	28.6	28.5	28.1	28.1	27.9	28.0	28.7	27.4
195	28.2	27.6	28.5	28.7	28.2	28.0	28.2	28.0	28.9	27.4
210	28.6	28.1	28.4	28.3	27.9	28.1	28.6	28.3	28.5	27.4
225	28.5	28.4	28.8	28.2	28.1	27.9	27.9	27.8	28.8	27.9
240	28.0	28.3	28.2	28.6	28.2	28.3	28.1	27.8	28.5	27.5

The numbers in table 6 to table 19 cannot be graphed, because the numbers are relatively similar to each other, and even though there are differences in numbers, the difference is very small.

Table 6, 8, 10, 12, 14, 16, and 18 are tables that show changes in fire propagation temperature to time (second).

All tables are sourced from the test results.

The highest fire propagation temperature is fabric two sides red and fabric antiskid white, with temperature 28.9°C. The lowest fire propagation temperature is fabric mesh with temperature 27.9°C, with deviation of the change in fire propagation temperature for 240 seconds is 6°C.

Code 1C: 1 salt: 3 MAP; 150 gram salt: 450 gram MAP; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric mesh, has lowest temperature 27.9°C. In the event of fire, if using fire blanket made from fabric mesh, temperature of fire heat ranges from 27.9°C.

Table 7: Code 1C, Propagation Length

Fabric	Propagation (inch)																
	Jeans	4	4	4	4	4	11	11	12	11	11	17	17	14	13	16	14
Corduroy	6	6	10	10	10	8	8	8	8	8	8	8	8	8	8	8	8
Body Rock	6	8	8	8	8	8	8	8	7.5	7.5	7	7	7	6	6	6	5
Two Sides Red	6.5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Two Sides Blue	5	10	10	10	10	10	5	5	5	5	5	5	5	5	5	5	5
Oscar Black	9	11	12	12	10	9	7	5	5	5	5	5	5	5	5	5	5
Anti Fire Korea	6	10	10	10	10	10	10	10	10	10	10	10	9	9	9	9	9
Antiskid Green	5	22	22	22	13	12	10	10	10	10	10	9	9	9	9	9	9
Antiskid White	10	12	22	14	12	11	11	11	11	11	11	11	11	11	11	11	11
Mesh	6	11	11	16	12	12	12	11	11	11	11	11	11	11	11	10	10

Table 7, 9, 11, 13, 15 17, and 19 are table show propagation length of each type of fabric.

The longest propagation length is fabric antiskid green and fabric antiskid white, which is 22 inches. The shortest propagation length is fabric two sides red, 6.5 inches.

Code 1C: 1 salt: 3 MAP; 150 gram salt: 450 gram MAP; soak 3 day, if viewed from propagation length, the best fabric is fabric two sides red. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric two sides red.

Table 8: Code 2C, 6 December 2018

Time (Second)	Fire Propagation Temperature (°C)					
	Body Rock	Two Sides Red	Two Sides Blue	Oscar Black	Anti Fire Korea	Antiskid White
0	24.4	25.4	24.8	25.0	25.4	27.7
15	24.7	25.4	24.5	24.8	25.3	27.7
30	24.9	25.5	24.7	24.8	25.5	27.2
45	24.5	25.7	24.5	24.9	25.2	27.6
60	24.9	25.7	24.6	24.4	25.2	27.6
75	25.0	25.9	24.2	24.6	25.1	27.8
90	24.8	26.1	24.7	24.5	24.6	27.5
105	24.6	25.2	24.7	24.6	25.1	27.8

Time (Second)	Fire Propagation Temperature (°C)					
	<i>Body Rock</i>	<i>Two Sides Red</i>	<i>Two Sides Blue</i>	<i>Oscar Black</i>	<i>Anti Fire Korea</i>	<i>Antiskid White</i>
120	25.0	25.1	24.4	25.0	25.1	27.6
135	25.2	26.0	24.8	24.6	24.9	27.6
150	24.9	25.9	24.6	24.9	24.9	27.7
165	25.2	26.0	24.4	25.0	24.9	27.5
180	25.6	25.4	24.8	24.7	24.9	27.5
195	25.4	26.2	24.6	25.1	24.5	27.5
210	25.3	25.9	24.5	24.8	24.7	28.0
225	25.3	25.8	24.8	25.1	24.0	27.6
240	25.1	26.2	24.6	25.2	24.9	28.2

The highest fire propagation temperature is fabric antiskid white, with temperature 28.2°C. the lowest fire propagation temperature is fabric two sides blue with temperature 24.8°C, with deviation of the change in fire propagation temperature for 240 seconds is 6°C.

Code 2C : 1 *natrium benzoate* : 3 *kalii carbonate* ;150 gram *natrium benzoate* : 450 gram *kalii carbonate* ; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric two sides blue, has lowest temperature 24.8°C. In the event of fire, if using fire blanket made from fabric two sides blue, temperature of fire heat ranges from 24.8°C.

Table 9: Code 2C, Propagation Length

Fabric	Propagation (inch)																
	6	6	13	13	13	10	10	9	9	9	9	9	9	9	9	9	
Body Rock	6	6	13	13	13	10	10	9	9	9	9	9	9	9	9	9	
Two Sides Red	5	6	13	5	5	5	5	5	5	5	5	5	5	5	5	5	
Two Sides Blue	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5.5	5.5	5.5
Oscar Black	8	8	15	22	20	4	4	4	4	4	4	4	4	4	4	4	
Anti-Fire Korea	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
Antiskid White	8	15	12	13	13	11	11	11	11	11	11	11	11	11	10	10	10

The longest propagation length is fabric oscar black, which is 22 inches. The shortest propagation length is fabric two sides blue, 5.5 inches.

Code 2C: 1 *natriumbenzoate*: 3 *kaliicarbonat*; 150 gram *natriumbenzoate*: 450 gram *kaliicarbonat*; soak 3 day, if viewed from propagation length, the best fabric is fabric two sides blue. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric two sides blue.

Table 10: Code 3C, 11 December 2018

Time (Second)	Fire Propagation Temperature (°C)									
	<i>Jeans</i>	<i>Corduroy</i>	<i>Body Rock</i>	<i>Two Sides Red</i>	<i>Two Sides Blue</i>	<i>Oscar Black</i>	<i>Oscar Orange</i>	<i>Antiskid Green</i>	<i>Antiskid White</i>	<i>Mesh</i>
0	26.8	27.0	28.3	28.9	28.5	28.1	26.9	27.5	27.5	27.3
15	27.0	26.9	28.5	28.5	28.5	28.2	27.5	27.6	27.0	27.0
30	26.8	26.9	28.0	28.7	28.2	27.9	27.6	27.4	27.1	27.3
45	26.6	27.1	28.4	29.0	28.6	28.1	27.2	29.2	27.2	26.9
60	26.9	26.5	28.1	28.5	28.5	27.8	27.0	29.2	26.7	27.3
75	27.0	26.5	28.2	28.8	28.6	28.2	27.6	29.1	27.0	27.3
90	27.0	26.5	28.4	28.8	28.6	28.2	27.2	28.4	27.2	27.6
105	27.5	27.0	28.8	28.6	28.2	28.0	27.2	28.1	27.0	27.7
120	27.4	27.2	28.4	28.9	28.8	28.4	28.0	28.3	27.2	27.6
135	26.2	27.2	28.2	28.9	28.2	28.2	27.5	28.7	27.2	27.6
150	26.7	26.8	28.4	28.7	28.6	28.3	28.1	28.0	27.0	27.4
165	27.0	26.9	28.3	28.4	28.5	28.3	27.7	27.8	27.3	27.2
180	26.9	27.2	27.8	28.9	28.6	28.1	28.2	28.2	27.5	28.1
195	27.1	27.1	28.1	28.7	28.3	28.3	27.9	28.4	27.1	27.9
210	27.2	26.8	28.2	29.1	28.2	28.2	28.1	27.6	27.2	28.0
225	26.9	27.0	27.8	29.2	28.5	28.4	27.7	28.0	27.2	28.2
240	26.6	27.1	28.1	29.2	28.5	28.6	27.3	28.0	26.8	27.4

The highest fire propagation temperature is fabric two sides red and fabric antiskid green, with temperature 29.2°C. The lowest fire propagation temperature is fabric corduroy with temperature 27.2°C, with deviation of the change in fire propagation temperature for 240 seconds is 7°C.

Code 3C : 1 *natrii nitrate* : 3 *ethylene glycol* ; 150 gram *natrii nitrate* : 450 gram *ethylene glycol* ; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric corduroy, has lowest temperature 27.2°C. In the event of fire, if using fire blanket made from fabric corduroy, temperature of fire heat ranges from 27.2°C.

Table 11: Code 3C, Propagation Length

Fabric	Propagation (inch)																
	6	11	22	22	15	15	15	14	14	13	13	13	13	13	13	12	12
Jeans	6	11	22	22	15	15	15	14	14	13	13	13	13	13	13	12	12
Corduroy	6	11	11	11	11	10	10	10	10	10	10	10	10	10	10	10	10
Body Rock	9	12	22	22	12	12	12	12	12	12	12	12	12	12	12	12	12
Two Sides Red	12	13	13	13	13	13	13	12	12	12	11	11	11	11	11	11	11
Two Sides Blue	13	22	17	12	12	12	12	12	11	11	11	11	11	11	11	11	11
Oscar Black	22	22	22	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Oscar Orange	15	17	22	22	22	22	22	17	14	12	12	11	11	11	11	11	11
Antiskid Green	5	22	22	22	22	10	10	10	10	10	10	10	10	10	10	10	10
Antiskid White	13	15	15	15	13	13	13	13	13	13	13	13	13	13	13	13	13
Mesh	6	18	22	22	22	20	10	10	8	8	7	6	5	5	5	5	5

The longest propagation length is fabric jeans, fabric body rock, fabric two sides blue, fabric oscar black, fabric oscar orange, fabric antiskid green, and fabric mesh, which is 22 inches. The shortest propagation length is fabric corduroy, 11 inches.

Code 3C : 1 *natrii nitrate* : 3 *ethylene glycol* ; 150 gram *natrii nitrate* : 450 gram *ethylene glycol* ; soak 3 day, if viewed from propagation length, the best fabric is fabric corduroy. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric corduroy.

Table 12: Code 4C, 6 December 2018

Time (Second)	Fire Propagation Temperature (°C)									
	<i>Jeans</i>	<i>Corduroy</i>	<i>Body Rock</i>	<i>Two Sides Red</i>	<i>Two Sides Blue</i>	<i>Oscar Black</i>	<i>Oscar Orange</i>	<i>Antiskid Green</i>	<i>Antiskid White</i>	<i>Mesh</i>
0	24.4	26.7	26.2	28.2	27.2	26.8	27.0	26.4	27.0	24.9
15	24.5	25.7	25.1	27.8	27.6	26.3	27.2	26.8	27.0	25.2
30	24.8	25.8	24.9	28.0	27.5	26.3	27.2	26.7	27.1	25.1
45	24.8	26.2	24.7	27.4	27.2	26.7	27.6	26.7	27.4	25.6
60	24.6	25.4	24.9	27.7	27.2	27.1	27.5	26.2	26.0	25.1
75	24.1	25.6	25.2	27.6	26.7	27.0	27.6	26.5	27.1	24.7
90	24.9	25.9	25.5	27.9	27.0	27.6	27.8	26.6	26.9	25.1
105	24.8	26.0	25.2	27.0	27.0	26.8	27.5	26.5	27.2	25.0
120	25.1	26.1	25.1	28.2	27.0	27.1	27.6	26.7	26.9	25.5
135	25.1	26.5	24.6	28.0	27.1	27.1	27.5	26.1	26.6	25.3

Time (Second)	Fire Propagation Temperature (°C)									
	Jeans	Corduroy	Body Rock	Two Sides Red	Two Sides Blue	Oscar Black	Oscar Orange	Antiskid Green	Antiskid White	Mesh
150	25.2	26.5	25.3	28.3	26.8	27.0	27.6	26.2	27.0	25.2
165	24.9	25.3	25.3	28.0	27.3	27.0	27.6	26.7	26.6	25.7
180	25.0	25.0	25.6	28.0	27.2	27.0	27.6	26.8	26.7	25.2
195	24.9	25.6	25.3	27.6	27.2	26.9	27.5	26.8	26.5	25.1
210	25.1	25.8	25.1	27.9	27.5	27.0	27.3	26.3	27.0	25.5
225	24.9	25.7	25.2	27.5	27.1	27.0	27.2	27.2	26.8	25.3
240	24.9	26.8	25.1	27.8	27.5	26.8	27.5	26.8	26.7	25.3

The highest fire propagation temperature is fabric two sides red, with temperature 28.3°C. The lowest fire propagation temperature is fabric jeans with temperature 25.2°C, with deviation of the change in fire propagation temperature for 240 seconds is 11°C.

Code 4C : 2 salt : 4 ethylene glycol ; 300 gram salt : 600 gramethylene glycol ; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric jeans, has lowest temperature 25.2°C. In the event of fire, if using fire blanket made from fabric jeans, temperature of fire heat ranges from 25.2°C.

Table 13: Code 4C, Propagation Length

Fabric	Propagation (inch)															
Jeans	6	7.5	16	22	10	10	10	10	10	10	10	10	10	10	10	10
Corduroy	6	11	15	19	19	9	9	8.5	8.5	8.5	8.5	8.5	8	8	8	8
Body Rock	9	12	22	20	9	9	9	9	9	9	9	9.5	9.5	9.5	9	9
Two Sides Red	12	11	9	9	9	9	9	10	10	10	10	10	10	10	10	10
Two Sides Blue	5	13	13	13	10	10	9	9	9	9	9	9	9	9	9	9
Oscar Black	6	10	22	22	22	22	22	10	10	10	5	5	5	5	5	4
Oscar Orange	5	10	12	22	12	16	14	12	12	12	12	12	12	12	12	12
Antiskid Green	9	22	12	12	12	12	12	12	11	11	10	10	10	10	10	10
Antiskid White	22	22	22	16	12	12	12	10	10	10	10	10	10	10	10	10
Mesh	6	9	11	20	22	22	22	22	22	21	21	15	16	15	15	10

The longest propagation length is fabric jeans, fabric body rock, fabric oscar black, fabric oscar orange, fabric antiskid green, fabric antiskid white, and fabric mesh, which is 22 inches. The shortest propagation length is fabric two sides red, 12 inches.

Code 4C: 2 salt: 4 ethylene glycol; 300 gram salt: 600 gram ethylene glycol; soak 3 day, if viewed from propagation length, the best fabric is fabric two sides red. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric two sides red.

Table 14: Code 6C, 30 November 2018

Time (Second)	Fire Propagation Temperature (°C)									
	Jeans	Corduroy	Body Rock	Two Sides Red	Two Sides Blue	Oscar Black	Oscar Orange	Antiskid Green	Antiskid White	Mesh
0	28.0	27.0	27.5	27.4	27.5	27.6	27.1	27.4	27.6	27.7
15	27.6	26.9	27.0	27.7	27.3	27.2	27.6	27.5	27.4	27.8
30	26.7	26.2	27.3	27.7	27.0	27.1	26.7	27.4	27.1	27.5
45	26.4	26.4	27.1	27.6	27.7	27.4	26.0	27.0	27.1	27.9
60	26.5	26.7	27.5	27.8	27.4	27.4	27.0	27.5	27.1	28.2
75	25.8	26.4	27.6	27.4	27.5	26.7	27.5	28.2	26.5	27.7
90	26.1	26.5	27.0	27.5	27.5	27.1	27.9	28.2	27.3	27.6
105	26.3	26.1	27.5	27.3	27.7	27.3	27.9	27.5	27.4	27.8
120	25.9	25.9	27.6	27.8	27.3	27.2	28.8	27.6	27.3	27.5
135	26.0	26.4	27.3	27.4	27.7	27.0	28.5	28.1	27.1	27.1
150	26.3	26.4	27.7	27.4	27.9	27.1	28.5	28.2	27.3	27.5
165	26.7	26.3	27.6	27.6	27.9	27.6	28.5	27.8	27.1	27.7
180	26.1	26.7	27.1	26.9	27.9	27.4	28.2	27.3	27.4	27.5
195	26.5	26.8	27.6	27.5	27.7	27.7	28.4	27.9	27.6	27.7
210	26.5	26.5	27.9	27.3	27.6	27.7	28.7	27.8	27.6	28.2
225	26.1	26.9	27.5	27.4	27.7	27.3	28.1	27.9	27.6	27.6
240	26.0	27.0	27.6	27.5	27.9	27.6	28.0	27.5	27.5	28.1

The highest fire propagation temperature is fabric oscar orange, with temperature 28.8°C. The lowest fire propagation temperature is fabric corduroy with temperature 27.0°C, with deviation of the change in fire propagation temperature for 240 seconds is 11°C.

Code 6C: 2 Natrium benzoate: 4 MAP; 300 gram natrium benzoate: 600 gram MAP; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric corduroy, has

lowest temperature 27.0°C. In the event of fire, if using fire blanket made from fabric corduroy, temperature of fire heat ranges from 27.0°C.

Table 15: Code 6C, Propagation Length

Fabric	Propagation (inch)																	
	Jeans	6	6	6	5	5	5	5	5	5	5	5	5	5	4.5	4	4	4
Corduroy	5	5	5	5	5	6	6	6	6	6	6	6	6	6	6	6	6	6
Body Rock	8.5	8.5	8.5	8.5	8	8	8	8	8	8	8	8	8	8	8	8	8	8
Two Sides Red	5.5	4.5	5	4.5	5	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6	5	5	4.5	5
Two Sides Blue	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	3	3	3
Oscar Orange	10	13	22	22	22	9	15	9	8	8	9	9	9	9	9	9	9	9
Antiskid Green	22	22	22	18	10	10	8	9	8	7	7	7	6.5	6	7	7	7	6.5
Antiskid White	8	8	12	16	12	12	8	9	8.5	9	9	9	9	9	9	9.5	9.5	9.5
Mesh	5	5	6	8	8.5	9	22	22	18	18	22	22	10	2	2	2	2	2

The longest propagation length is fabric oscar orange, fabric antiskid green, and fabric mesh, which is 22 inches. The shortest propagation length is fabric two sides blue, 4 inches.

Code 6C: 2 Natrium benzoate: 4 MAP; 300 gram natrium benzoate: 600 gram MAP; soak 3 day, if viewed from propagation length, the best fabric is fabric two sides blue. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric two sides blue.

Table 16: Code 8C, 12 December 2018

Time (Second)	Fire Propagation Temperature (°C)									
	Jeans	Corduroy	Body Rock	Two Sides Red	Two Sides Blue	Oscar Black	Oscar Orange	Antiskid Green	Antiskid White	Mesh
0	28.1	29.7	29.8	28.1	29.1	28.5	29.0	29.4	28.5	27.0
15	28.6	29.8	29.4	28.2	29.4	28.5	28.6	29.5	28.9	27.0
30	28.6	28.9	29.8	28.6	29.0	28.0	29.2	28.9	28.9	26.6
45	28.1	29.1	29.2	28.3	29.4	28.3	29.1	29.3	28.6	27.0

Time (Second)	Fire Propagation Temperature (°C)									
	Jeans	Corduroy	Body Rock	Two Sides Red	Two Sides Blue	Oscar Black	Oscar Orange	Antiskid Green	Antiskid White	Mesh
60	27.9	29.4	29.5	27.9	29.6	28.5	28.9	29.5	28.6	27.0
75	28.2	29.1	29.4	28.5	29.3	28.0	28.9	29.0	29.0	27.0
90	28.8	29.5	29.5	28.3	29.2	28.9	29.3	29.1	28.7	26.9
105	28.4	29.7	29.8	28.2	29.8	29.0	28.7	29.4	28.7	27.0
120	28.8	29.5	30.0	28.5	29.3	28.9	29.0	28.8	28.7	27.2
135	28.9	29.5	29.4	28.7	29.5	28.9	29.2	29.5	28.5	26.8
150	28.7	29.8	29.6	28.6	29.5	27.9	28.9	29.6	29.0	27.1
165	28.6	29.3	29.8	29.0	29.4	28.6	29.1	29.0	29.0	27.1
180	29.0	29.4	29.2	28.7	29.3	28.3	28.7	29.6	28.6	26.8
195	28.8	29.3	29.7	28.5	29.7	28.4	29.2	29.2	28.5	27.2
210	28.6	29.4	29.9	28.8	29.2	28.1	29.5	29.2	28.8	27.3
225	28.1	29.6	29.2	28.4	29.0	28.4	29.1	29.4	28.6	27.2
240	29.0	29.2	29.1	28.7	29.3	28.3	29.3	29.2	28.1	27.2

The highest fire propagation temperature is fabric body rock, with temperature 30.0°C. the lowest fire propagation temperature is fabric mesh with temperature 27.3°C, with deviation of the change in fire propagation temperature for 240 seconds is 7°C.

Code 8C : 3 natrium benzoate : 5 ethylene glycol ; 450 gramnatrium benzoate : 750 gramethylene glycol ; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric mesh, has lowest temperature 27.3°C. In the event of fire, if using fire blanket made from fabric mesh, temperature of fire heat ranges from 27.3°C.

Table 17: Code 8C, Propagation Length

Fabric	Propagation (inch)															
Jeans	14	22	22	13	13	13	13	13	13	13	12	12	12	12	12	12
Corduroy	10	13	22	14	12	12	12	12	12	12	11	11	11	11	11	11
Body Rock	10	13	13	13	12	12	12	12	12	12	11	11	11	11	11	11
Two Sides Red	13	22	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Two Sides Blue	13	22	17	14	12	12	12	12	12	12	12	12	12	12	12	12
Oscar Black	13	22	22	22	13	13	13	13	13	13	13	13	13	13	13	13
Oscar Orange	12	22	22	22	22	20	19	13	13	13	13	13	12	12	12	11

Fabric	Propagation (inch)															
	Antiskid Green	6	22	22	22	19	14	14	14	13	13	12	12	12	12	12
Antiskid White	8	22	14	12	12	12	12	12	12	12	12	12	12	12	12	12
Mesh	13	22	22	22	22	22	22	13	13	13	13	13	13	13	13	13

The longest propagation length is fabric jeans, fabric corduroy, fabric two sides red, fabric two sides blue, fabric oscar black, fabric oscar orange, fabric antiskid green, fabric antiskid white, and fabric mesh, which is 22 inches. The shortest propagation length is fabric body rock, 13 inches.

Code 8C: 3 natriumbenzoate: 5 ethylene glycol; 450 gramnatriumbenzoate: 750 gramethylene glycol; soak 3 day, if viewed from propagation length, the best fabric is fabric body rock. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric body rock.

Table 18: Code 9C, 4 December 2018

Time (Second)	Fire Propagation Temperature (°C)									
	<i>Jeans</i>	<i>Corduroy</i>	<i>Body Rock</i>	<i>Two Sides Red</i>	<i>Two Sides Blue</i>	<i>Oscar Black</i>	<i>Oscar Orange</i>	<i>Antiskid Green</i>	<i>Antiskid White</i>	<i>Mesh</i>
0	24.9	25.1	24.8	25.4	25.2	27.9	25.5	26.1	24.8	26.3
15	25.3	24.7	25.1	25.6	25.1	27.2	25.2	26.0	25.5	26.3
30	25.3	25.0	25.3	25.5	25.6	26.9	25.8	25.8	25.9	26.3
45	24.9	25.0	25.1	25.4	25.6	25.9	26.2	25.6	25.6	26.4
60	25.1	25.0	25.3	25.6	25.6	26.1	25.7	25.7	25.7	26.1
75	25.4	24.8	25.5	25.2	25.3	26.1	26.1	25.9	25.9	26.0
90	25.1	25.1	25.1	25.4	25.4	25.7	28.2	26.3	25.5	26.0
105	25.3	25.1	25.0	25.4	25.3	25.9	27.6	26.1	25.4	26.3
120	25.6	24.8	25.3	24.9	25.6	26.1	28.0	26.0	25.7	25.8
135	25.6	25.2	25.4	25.4	25.5	25.8	27.7	26.3	25.6	26.2
150	25.2	25.3	25.1	25.5	25.6	25.8	26.7	26.4	25.5	25.9
165	25.7	25.1	25.4	25.3	25.6	26.0	27.0	25.8	26.0	26.3
180	25.9	25.2	25.7	25.4	25.3	26.0	26.8	26.1	26.2	26.2
195	25.2	25.4	25.2	25.7	25.5	25.9	26.2	25.8	25.6	26.0
210	25.6	25.1	25.6	25.6	26.1	25.8	26.3	26.0	25.9	26.2
225	25.8	25.0	25.7	25.4	25.6	26.1	26.7	26.1	25.9	26.2
240	25.6	25.5	25.1	25.8	26.1	25.8	26.3	26.1	25.9	26.1

The highest fire propagation temperature is fabric oscar orange, with temperature 28.2°C. The lowest fire propagation temperature is fabric corduroy with temperature 25.5°C, with deviation of the change in fire propagation temperature for 240 seconds is 8°C.

Code 9C : 3 *natrii nitrate* : 5 MAP ; 450 gram *natrii nitrate* ; 750 gram MAP ; soak 3 day, when viewed from fire propagation temperature, the best fabric is fabric corduroy, has lowest temperature 25.5°C. In the event of fire, if using fire blanket made from fabric corduroy, temperature of fire heat ranges from 25.5°C.

Table 19: Code 9C, Propagation Length

Fabric	Propagation (inch)																
	7.5	7.5	8	7	6	6	6	6	6	6	6	6	6	6	6	6	6
Jeans	7.5	7.5	8	7	6	6	6	6	6	6	6	6	6	6	6	6	6
Corduroy	5	6	6	7	7.5	8	8	7	7	6	6.5	6.5	6.5	6.5	6.5	8	8
Body Rock	8	8.5	9	9	9	8.5	8	7.5	7	6.5	6	6	6	6	8	8	8
Two Sides Red	2	4	8	22	9	9	9	9	9	9	9	9	8.5	8.5	8.5	8	8
Two Sides Blue	6	22	22	22	18	5	5	5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Oscar Black	12	22	16	13	8	8	8	8	8	8	8	8	8	8	8	8	8
Oscar Orange	12	15	22	22	22	22	20	12	12	10	10	10	10	10	9	9	9
Antiskid Green	2	6	12	22	22	14	14	12	10	10	10	10	9	9	9	9	9
Antiskid White	17	22	22	16	17	20	19	13	13	13	13	13	13	13	13	13	13
Mesh	5	6	8	10	22	22	22	18	4	4	4	2	2	2	2	2	2

The longest propagation length is fabric two sides red, fabric two sides blue, fabric oscar black, fabric oscar orange, fabric antiskid green, fabric antiskid white, and fabric mesh, which is 22 inches. The shortest propagation length is fabric jeans and fabric corduroy, 8 inches.

Code 9C : 3 *natrii nitrate* : 5 MAP ; 450 gram *natrii nitrate* ; 750 gram MAP ; soak 3 day, if viewed from propagation length, the best fabric is fabric jeans and fabric corduroy. In the event of fire, the lowest propagation length will be obtained when using fire blanket from fabric jeans and fabric corduroy.

5. Conclusion

The prediction value of flame spread of fire blanket fabric is as follows:

Table 20: Prediction Value of Flame Spread

No	Fabric	Prediction FS Value E84						
		1 C	2 C	3 C	4 C	6 C	8 C	9 C
1	Jeans	125.3	-	160.3	160.3	47.1	160.3	61.8
2	Corduroy	75.6	-	83	139.1	47.1	160.3	61.8
3	Body Rock	61.8	96.8	160.3	160.3	65.5	96.8	68.3
4	Two Sides Red	50.8	96.8	96.8	89.4	47.1	160.3	160.3
5	Two Sides Blue	75.6	43.4	160.3	96.8	33.3	160.3	160.3
6	Oscar Black	89.4	160.3	160.3	160.3	-	160.3	160.3
7	Anti Fire Korea	75.6	47.1	-	-	-	-	-
8	Oscar Orange	-	-	160.3	160.3	160.3	160.3	160.3
9	Antiskid Green	160.3	-	160.3	160.3	160.3	160.3	160.3
10	Antiskid White	160.3	111.5	111.5	160.3	118	160.3	160.3
11	Mesh	118	-	160.3	160.3	160.3	160.3	160.3

Classification based on FSvalue :

- Class I : 0 – 25
- Class II : 26 – 75
- Class III : 76 – 200

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