

鮮明 堅牢 樹脂着色剤

# Kayaset & Kayalight

鮮明蛍光色——— Kayaset Fシリーズ  
 PS, MMA その他一般用— Kayaset 汎用タイプ(無印)  
 ABSその他高堅牢用—— Kayaset Aシリーズ  
 エンブラ, その他高堅牢用— Kayaset Eシリーズ  
 蛍光増白用——— Kayalight

Kayaset F Colours, Kayaset Colours, Kayaset A Colours, Kayaset E Colours and Kayalight are useful for resin colouring.

Kayaset F colours have the vivid shade with notable brilliancy or fluorescence especially.

Kayaset Colours are recommended for polystyrene and polymethyl methacrylate resins.

Kayaset A Colours possess the excellent fastness properties and are suited for polystyrene, polymethyl methacrylate and acrylonitril-butadien-styrene so called ABS resins.

Kayaset E Colours possess the high performance and are suitable for Engineering plastics (PET, PPO & so on)

Kayalights are the very effective fluorescent whitening agents for resins.

## General Properties of Kayaset Colours.

General properties of Kayaset Colours are assessed as follows.

### 1. Fastness to light

The coloured plates with 0.03% of Kayaset Colours (Black 0.1%) on each resin are exposed with the carbon arc light in Fade-0-meter.

### 2. Fastness to heating

0.03% of Kayaset Colours (Black 0.1%) is blended into resin and the resin is treated with heating cylinder in the inline-screwtype injector as following conditions.

Then continuous molding is carried out the change in shade is assessed.

Resin	Temperature	Duration
PS	300°C / 572°F	10 min
ABS	280°C / 536°F	5 min
MMA	250°C / 482°F	10 min
Polycarbonate	300°C / 572°F	10 min
Nylon	300°C / 572°F	10 min
PET	280°C / 536°F	5 min

### 3. Fastness to bleeding

0.03% of Kayaset Colours (Black 0.1%) is blended into resin [A].

0.5% of titanium R type is blended into white soft-PVC [B].

[A] and [B] is piled up and treated with heatpress at 110°C / 230°F for 10minutes under 10kg/cm<sup>2</sup>. The degree of bleeding is assessed.

### 4. Sublimation test

A proper quantity of Kayaset Colours is put into a glass test tube and heated at 200°C / 392°F for 10 minutes, the degree of colour attached inside of the test tube is assessed.

### 5. Solubility to organic solvent.

Excess Kayaset Colours are dissolved into the each solvent and kept. on at 20°C / 68°F for 24hours with stirring, then the saturated solution is filtered, then the filtrate is measured with spectrophotometer.

### 6. Testing Material

Abbreviation	Commercial name
PS-GP	Stylon 666
PS-HI	Stylon 475
ABS	JSR ABS 10
MMA	Acrypet M
Polycarbonate	Iupion 2000
Nylon	Amilan CM-1001-A
PET	PET RA 533

### Signification of Ratings

Ratings	1	2	3	4	5	6	7	8
Light fastness with blue scale	Very poor	Poor	Fair	Fairly good	Good	Very good	Excellent	Out-standing
Other fastness with grey scale	Poor (much)	Fair(Con-siderable)	Fairly good (Distinct)	Good (Slight)	Very good (Virtually)			

## カヤセットカラーの諸性質

### 〔試験条件〕

#### ○耐光性試験

各樹脂に対しカヤセットカラー0.03%(ブラックは0.1%)濃度の着色成型板を作成し、フュードメーター照射を行い、変色の度合いをJIS変退色用ブルースケールで判定表示を行いました。

#### ○耐熱性試験

インジェクション直接法…各樹脂に対しカヤセットカラー0.03%(ブラックは0.1%)をブレンドし、インラインスクリーナー式インジェクションを使用し、加熱シリンダー内に10分間(ABS、PETは5分間)滞留させたのち、連続成型を行い変色の度合いをJIS変退色用グレースケールで判定表示を行いました。

#### ○ブリード性試験

各樹脂に対しカヤセットカラー0.03%(ブラックは0.1%)濃度の着色成型板とR型TiO<sub>2</sub>0.5%着色加工された軟質PVC白シートを合わせ、熱プレスにて110℃×10kg/cm×10分間の条件でブリードさせ汚染の度合いをJIS汚染用グレースケールで判定表示を行いました。

#### ○有機溶媒溶解性試験

各溶媒に大過剰のカヤセットカラーを加え、20℃で時々攪拌しながら一夜放置後東洋濾紙No.6で自然濾過し、得られた飽和溶液を通常の分光法で濃度(溶解度)測定を行いました。

なお、有機溶媒中の略号は下記のとおりです。

DMF……ジメチルホルムアミド

MEK……メチルエチルケトン

DOP……ジオクチルフタレート

#### ○昇華性試験

ガラス製秤量瓶中に試料の適量を入れ、その上に塩ビ白シートをのせ200℃の電機乾燥器で10分間加熱し昇華させ塩ビ白シートの汚染の度合いをJIS汚染用グレースケールで判定表示を行いました。

### 〔使用樹脂〕

PS-GP	スタイロン 666	MMA	アクリベット M
PS-HI	スタイロン 475	P C	ユーピロン 2000
ABS	スタイラック 200	Nylon	アミラン CM 1001-A
ABS	JSR ABS 10	PET	PET RA 533

#### ○日光堅牢度等級の評語

日光堅牢度級(級)	1	2	3	4	5	6	7	8
評語	最弱	弱	可	やや良	良	きわめて良	優	秀

品名 Colours	着色見本 Colour Sample (TiO <sub>2</sub> (R)0.5%)	品名 Colours	着色見本 Colour Sample (TiO <sub>2</sub> (R)0.5%)
Kayaset Flavine FN		Kayaset Yellow 2G	
Kayaset Flavine FG		Kayaset Yellow GN	
Kayaset Yellow SF-G		Kayaset Orange G	販売量少量につき 販売中止
Kayaset Orange SF-R	販売量少量につき 販売中止	Kayaset Red G	
Kayaset Red SF-4G		Kayaset Red 130	
Kayaset Red SF-B		Kayaset Red B	
Kayaset Blue FR		Kayaset Blue N	

品名 Colours	着色見本 0.1% (Black 0.2%) Colour Sample (TiO <sub>2</sub> (R)0.5%)	品名 Colours	着色見本 0.1% Colour Sample (TiO <sub>2</sub> (R)0.5%)
Kayaset Black G		Kayaset Yellow A-G	
Kayaset Black B		Kayaset Orange A-N	
		Kayaset Red A-G	
		Kayaset Red A-2G	
Kayaset Black A-N		Kayaset Red A-BR	
Kayaset Green A-B		Kayaset Violet A-R	
Kayaset Blue A-D	販売量少量につき 販売中止	Kayaset Blue A-2R	

品名 Colours	着色見本 0.1% Colour Sample (TiO <sub>2</sub> (R)0.5%)	品名 Colours	着色見本 0.1% Colour Sample (TiO <sub>2</sub> (R)0.5%)
Kayaset Yellow E-G		Blank ブランク	
Kayaset Yellow E-AR	販売量少量につき 販売中止	Kayalight B	
Kayaset Red E-CG		Kayalight OS	
Kayaset Red E-BG		Kayalight OSN	
Kayaset Blue ACR	販売量少量につき 販売中止		

General Property of Kayaset Colours

Colours	Property													PS-GP		
	Melting point (approx) °C / °F	Sublimation (200°C / 392°F x 10min)	Solubility to organic solvent 20°C / 68°F (g / 100ml)										Light	Heating 300°C / 572°F x 10min	Bleeding	
			Ethanol	Acetone	Ethyl acetate	Dimethylform- amide	Methyl-ethyl- ketone	Xylene	Perchloro- ethylene	Dioctyl- phthalate	Light	Heating 300°C / 572°F x 10min				Bleeding
Fluorescent Colour-F-Type	Kayaset Flavine FN	285/545	5	0.10	1.12	0.23	5.15	1.43	0.01	insolu- ble	0.04	5-6	5	3-4		
	Kayaset Flavine FG	125/257	3	0.84	4.06	2.37	21.50	6.61	0.90	0.68	1.40	5	5	3		
	KST Yellow SF-G	214/417	5	0.31	0.49	0.03	1.57	0.07	0.01	0.05	0.01	7	4-5	3		
	KST Orange SF-R	257/495	4-5	insolu- ble	0.01	0.01	0.14	0.04	0.01	insolu- ble	0.01	7-8	4-5	3-4		
	KST Red SF-4G	268/514	5	"	0.06	0.02	0.20	0.03	0.02	"	insolu- ble	7	4-5	3		
	KST Red SF-B	272/522	5	"	0.08	0.01	0.24	0.15	insolu- ble	"	"	8	5	2-3		
For Resin Colouring	Kayaset Blue FR	210/410	2	0.04	0.19	0.17	0.40	0.29	0.23	0.28	0.2	6-7	5	2-3		
	Kayaset Yellow 2G	240/464	3	0.07	0.25	0.19	0.87	0.34	0.25	0.16	0.13	8	5	2-3		
	Kayaset Yellow GN	183/361	3-4	0.01	1.10	1.00	2.24	1.14	0.22	0.48	0.01	8	5	3		
	Kayaset Orange G	190/374	3-4	0.11	0.73	0.59	2.82	1.19	0.45	0.25	0.46	8	5	2		
	Kayaset Red G	170/338	1	0.06	0.51	0.53	1.70	0.69	0.81	0.27	0.42	8	5	3		
	Kayaset Red 130	230/446	2	0.03	0.10	0.17	0.39	0.21	0.3	0.33	0.10	6	5	2-3		
	Kayaset Red B	180/356	2-3	0.06	1.06	1.00	7.61	1.58	1.12	0.95	0.73	8	5	2-3		
	Kayaset Blue N	120/248	3	0.17	1.09	1.35	2.15	2.59	5.03	5.61	0.18	6-7	5	2-3		
	Kayaset Black G	—	2	0.23	1.24	1.32	3.00	1.67	1.87	2.02	1.12	8	5	2		
	Kayaset Black B	—	2	0.37	1.52	1.37	5.01	2.48	2.02	4.92	1.15	8	5	2		
High fastness-A-Type	Kayaset Yellow A-G	265/509	3	0.01	0.07	0.08	0.26	0.09	0.17	0.11	0.10	8	5	2-3		
	Kayaset Orange A-N	230/446	3-4	0.01	0.11	0.16	0.36	0.17	0.44	0.31	0.12	8	5	3		
	Kayaset Red A-G	310/590	5	insolu- ble	insolu- ble	0.01	0.02	0.01	0.09	0.02	0.01	8	5	3-4		
	Kayaset Red A-2G	255/491	4	"	0.06	0.07	0.28	0.10	0.25	0.23	0.10	8	5	3		
	Kayaset Red A-BR	265/509	4	0.01	0.07	0.05	1.33	0.09	0.04	0.06	0.08	8	5	2-3		
	Kayaset Violet A-R	210/410	3	0.03	0.29	0.50	1.01	0.89	2.46	2.68	0.57	8	5	3		
	Kayaset Blue A-2R	180/356	4	0.04	0.36	0.61	1.07	0.78	1.63	1.58	0.63	7-8	5	2-3		
	Kayaset Blue A-D	—	3-4	0.05	0.46	0.72	1.33	0.99	1.97	2.61	0.59	7-8	5	3		
	Kayaset Green A-B	210/410	3-4	0.01	0.14	0.25	0.46	0.36	0.88	1.26	0.23	7	5	3		
	Kayaset Black A-N	—	2	0.09	0.96	1.37	2.26	2.93	2.29	2.86	0.82	8	5	2		
	Engineering-E-Type	Kayaset Yellow E-G	380/716	5	insolu- ble	insolu- ble	insolu- ble	insolu- ble	insolu- ble	insolu- ble	insolu- ble	insolu- ble	4-5	5	4	
		Kayaset Yellow E-AR	424/795	4	"	"	"	"	"	"	"	"	7	4-5	4-5	
Kayaset Red E-CG		302/576	5	"	"	"	0.02	"	0.28	0.01	"	7	4	3		
Kayaset Red E-BG		325/617	5	"	"	"	0.01	"	0.06	insolu- ble	"	7	3-4	3-4		
Kayaset Blue A-CR		130/266	3	0.03	0.60	1.30	2.74	1.60	17.0	15.6	0.02	7	3-4	4		
Fluorescent whitener	Kayalight B	71/160	1-2	23.40	51.10	32.70	72.30	47.70	44.90	29.10	20.20	3	1-2	1-2		
	Kayalight OS	82/180	4-5	0.08	0.32	0.41	0.63	0.42	0.50	0.57	0.19	5	1-2	4		
	Kayalight OSN	110/230	4-5	0.08	0.32	0.41	0.63	0.42	0.50	0.57	0.19	5	1-2	4		

Shade depth 0.03% (Black 0.1%)

Colours	Fastness																					
	PS-GP (TiO <sub>2</sub> 0.5%)			PS-HI			ABS			MMA			Polycarbonate		Nylon		PET					
	Light	Heating 280°C / 536°F x 10min	Bleeding	Light	Heating 280°C / 536°F x 10min	Bleeding	Light	Heating 280°C / 536°F x 5 min	Bleeding	Light	Heating 280°C / 536°F x 10min	Bleeding	Light	Heating 300°C / 572°F x 10min	Bleeding	Light	Heating 300°C / 572°F x 10min	Bleeding	Light	Heating 280°C / 536°F x 5 min	Bleeding	
Fluorescent Colour-F-Type	Kayaset Flavine FN	3-4	4-5	2-3	3	4	3-4	3-4	5	4	6	5	4-5	4-5	5	4-5	3-4	5	4-5			
	Kayaset Flavine FG	3	4-5	2	3	4-5	3	3-4	5	3-4	6	5	4-5	4	5	4	3-4	5	4			
For Resin Colouring	KST Yellow SF-G	6	4	3	4	3-4	3-4	3-4	4-5	4-5	6-7	4	4	7-8	3-4	4	3-4	2-3	4-5			
	KST Orange SF-R	6-7	4	3-4	4	3-4	4-5	4-5	5	4-5	8	5	4-5	6	4-5	4	3-4	4	4-5			
	KST Red SF-4G	6-7	4	3	4	3-4	3	4	3-4	4-5	4	4	4-5	8	3-4	4	1-2	2	4-5			
	KST Red SF-B	7-8	5	2-3	4	3	3	3-4	5	4-5	6	4-5	4	8	4-5	3-4	1-2	2-3	4-5			
	Kayaset Blue FR	5-6	3-4	2	6	3	2-3	4-5	4	3	5-6	4	4	6-7	3	4	5-6	1	4			
	Kayaset Yellow 2G	4	5	2	5	4-5	2-3	5	5	3	7	5	4	6	5	4	7	2	3-4			
	Kayaset Yellow GN	6	4	2-3	8	3-4	3	5	2	3-4	7	5	4-5	—	—	—	—	—	—			
	Kayaset Orange G	6	3-4	1-2	7	3-4	2-3	6	1	2-3	8	5	4	7	5	3-4	4	1	5			
	Kayaset Red G	6-7	5	2	6-7	4	3	3-4	4-5	3-4	8	5	4	8	5	4	3-4	2-3	3			
	Kayaset Red 130	4	5	2	6	4	2-3	3-4	4	3	7	5	4	6-7	5	4	—	—	—			
High fastness-A-Type	Kayaset Red B	5	5	2	6	4	2-3	6	4-5	3	8	5	4	7-8	5	4	4	1	4			
	Kayaset Blue N	5-6	3-4	2	6-7	3	2-3	4	3-4	3	5-6	4	4	6	3	3-4	5-6	1	4			
	Kayaset Black G	5	4	2	7	4	2	5	4	2-3	8	5	4	7-8	5	3-4	4-5	2-3	3-4			
	Kayaset Black B	5	4	2	7	4	2	5	4	2-3	6	5	4	6-7	5	3-4	4-5	2	3-4			
	Kayaset Yellow A-G	8	5	2	8	5	2-3	8	5	3	8	5	4	8	5	4	7	2	4			
	Kayaset Orange A-N	8	5	2-3	8	5	3-4	6-7	5	4	8	5	4-5	8	5	4-5	7	5	4-5			
	Kayaset Red A-G	5-6	5	2-3	7	4	3-4	4	5	3-4	6	5	4-5	8	5	4-5	7	4-5	5			
	Kayaset Red A-2G	7-8	5	2	7	4	3	7	5	3-4	8	5	4-5	6-7	5	4-5	7	5	4			
	Kayaset Red A-BR	4-5	5	2	6	4	2-3	8	5	3	6-7	5	4	7	5	4	7	5	4			
	Kayaset Violet A-R	6	5	2	6-7	4	2-3	2	4	3	8	5	4	7-8	5	4	3	2	4			
	Kayaset Blue A-2R	5-6	4-5	2	6-7	3-4	2-3	3-4	4	3	8	5	4	8	5	4	3-4	1	4-5			
	Kayaset Blue A-D	5-6	4-5	2	7	4	3	4-5	4-5	3	7-8	5	4	8	5	4	4-5	2-3	4			
Engineering-E-Type	Kayaset Green A-B	5-6	4-5	2	7-8	4	2	5	5	3	8	5	4	8	5	3-4	6-7	2	3-4			
	Kayaset Black A-N	3	5	3	1	4	4	1	4	4	4	5	4-5	6	5	4-5	3	4	5	7	3	4
	Kayaset Yellow E-G	7	4-5	4-5	6	4	4-5	5-6	3	4-5	8	4-5	4-5	7	2-3	4	4-5	2-3	4-5	7	3-4	4-5
	Kayaset Red E-CG	7-8	4	3	7	3-4	4-5	6	3-4	4-5	5	4	4-5	7	4-5	4	4-5	3	4-5	7	4-5	4-5
	Kayaset Red E-BG	7-8	3-4	3-4	6-7	3-4	4-5	6	3-4	4-5	8	4	4-5	7	4	4	4-5	2-3	4-5	7	4-5	4-5
Fluorescent whitener	Kayalight B	3			3	1-2	1				3-4	5	4	1	2-3	2-3	—	—	—	—	—	—
	Kayalight OS	6			4	1-2	4				5	5	4-5	5	2-3	2-3	—	—	—	—	—	
	Kayalight OSN	6			4	1-2	4				5	5	4-5	5	2-3	2-3	—	—	—	—	—	

染料名	諸性質											PS-GP		
	融点 ℃/°F	昇華性 200℃ ×10min	有機溶媒溶解性 (20℃ g/100ml飽和溶液)								耐光性 300℃ ×10min	耐熱性 300℃ ×10min	耐フリード性	
			エタノール	アセトン	酢酸エチル	D M F	M E K	キシレン	パーケレン	D O P				
鮮明蛍光色 ドタイプ	Kayaset Flavine FN	285 545	5	0.10	1.12	0.23	5.15	1.43	0.01	難溶	0.04	5-6	5	3-4
	Kayaset Flavine FG	125 257	3	0.84	4.06	2.37	21.50	6.61	0.90	0.68	1.40	5	5	3
	KST Yellow SF-G	214 417	5	0.31	0.49	0.03	1.57	0.07	0.01	0.05	0.01	7	4-5	3
	KST Orange SF-R	257 495	4-5	難溶	0.01	0.01	0.14	0.04	0.01	難溶	0.01	7-8	4-5	3-4
	KST Red SF-4G	268 514	5	"	0.06	0.02	0.20	0.03	0.02	"	難溶	7	4-5	3
	KST Red SF-B	272 522	5	"	0.08	0.01	0.24	0.15	難溶	"	"	8	5	2-3
	Kayaset Blue FR	210 410	2	0.04	0.19	0.17	0.40	0.29	0.23	0.28	0.2	6-7	5	2-3
一般樹脂着色剤 無印	Kayaset Yellow 2G	240 464	3	0.07	0.25	0.19	0.87	0.34	0.25	0.16	0.13	8	5	2-3
	Kayaset Yellow GN	183 361	3-4	0.01	1.10	1.00	2.24	1.14	0.22	0.48	0.01	8	5	3
	Kayaset Orange G	190 374	3-4	0.11	0.73	0.59	2.82	1.19	0.45	0.25	0.46	8	5	2
	Kayaset Red G	170 338	1	0.06	0.51	0.53	1.70	0.69	0.81	0.27	0.42	8	5	3
	Kayaset Red 130	230 446	2	0.03	0.10	0.17	0.39	0.21	0.3	0.33	0.10	6	5	2-3
	Kayaset Red B	180 356	2-3	0.06	1.06	1.00	7.61	1.58	1.12	0.95	0.73	8	5	2-3
	Kayaset Blue N	120 248	3	0.17	1.09	1.35	2.15	2.59	5.03	5.61	0.18	6-7	5	2-3
	Kayaset Black G		2	0.23	1.24	1.32	3.00	1.67	1.87	2.02	1.12	8	5	2
	Kayaset Black B		2	0.37	1.52	1.37	5.01	2.48	2.02	4.92	1.15	8	5	2
高堅牢度 Aタイプ	Kayaset Yellow A-G	265 509	3	0.01	0.07	0.08	0.26	0.09	0.17	0.11	0.10	8	5	2-3
	Kayaset Orange A-N	230 446	3-4	0.01	0.11	0.16	0.36	0.17	0.44	0.31	0.12	8	5	3
	Kayaset Red A-G	310 590	5	難溶	難溶	0.01	0.02	0.01	0.09	0.02	0.01	8	5	3-4
	Kayaset Red A-2G	255 491	4	"	0.06	0.07	0.28	0.10	0.25	0.23	0.10	8	5	3
	Kayaset Red A-BR	265 509	4	0.01	0.07	0.05	1.33	0.09	0.04	0.06	0.08	8	5	2-3
	Kayaset Violet A-R	210 410	3	0.03	0.29	0.50	1.01	0.89	2.46	2.68	0.57	8	5	3
	Kayaset Blue A-2R	180 356	4	0.04	0.36	0.61	1.07	0.78	1.63	1.58	0.63	7-8	5	2-3
	Kayaset Blue A-D		3-4	0.05	0.46	0.72	1.33	0.99	1.97	2.61	0.59	7-8	5	3
	Kayaset Green A-B	210 410	3-4	0.01	0.14	0.25	0.46	0.36	0.88	1.26	0.23	7	5	3
	Kayaset Black A-N		2	0.09	0.96	1.37	2.26	2.93	2.29	2.86	0.82	8	5	2
エンブラ用 Eタイプ	Kayaset Yellow E-G	380 716	5	難溶	難溶	難溶	難溶	難溶	難溶	難溶	難溶	4-5	5	4
	Kayaset Yellow E-AR	424 795	4	"	"	"	"	"	"	"	"	7	4-5	4-5
	Kayaset Red E-CG	302 576	5	"	"	"	0.02	"	0.28	0.01	"	7	4	3
	Kayaset Red E-BG	325 617	5	"	"	"	0.01	"	0.06	難溶	"	7	3-4	3-4
	Kayaset Blue A-CR	130 266	3	0.03	0.60	1.30	2.74	1.60	17.0	15.6	0.02	7	3-4	4
蛍光増白剤	Kayalight B	71/160	1-2	23.40	51.10	32.70	72.30	47.70	44.90	29.10	20.20	3	1-2	1-2
	Kayalight OS	82/180	4-5	0.08	0.32	0.41	0.63	0.42	0.50	0.57	0.19	5	1-2	4
	Kayalight OSN	110/230	4-5	0.08	0.32	0.41	0.63	0.42	0.50	0.57	0.19	5	1-2	4

PS-GP (TiO <sub>2</sub> 0.5%)		堅牢度															
		PS-HI			ABS			MMA		Polycarbonate		Nylon		PET			
耐光性	耐熱性 300℃ ×10min	耐フリード性	耐光性 300℃ ×10min	耐熱性 280℃ ×5min	耐フリード性	耐光性 250℃ ×10min	耐熱性 300℃ ×10min	耐フリード性	耐光性 300℃ ×10min	耐熱性 300℃ ×10min	耐フリード性	耐光性 300℃ ×10min	耐熱性 280℃ ×5min	耐フリード性	耐光性	耐熱性	耐フリード性
3-4	4-5	2-3	3	4	3-4	3-4	5	4	6	5	4-5	4-5	5	4-5	3-4	5	4-5
3	4-5	2	3	4-5	3	3-4	5	3-4	6	5	4-5	4	5	4	3-4	5	4
6	4	3	4	3-4	3-4	3-4	4-5	4-5	6-7	4	4	7-8	3-4	4	3-4	2-3	4-5
6-7	4	3-4	4	3-4	4-5	4-5	5	4-5	8	5	4-5	6	4-5	4	3-4	4	4-5
6-7	4	3	4	3-4	3	4	3-4	4-5	4	4	4-5	8	3-4	4	1-2	2	4-5
7-8	5	2-3	4	3	3	3-4	5	4-5	6	4-5	4	8	4-5	3-4	1-2	2-3	4-5
5-6	3-4	2	6	3	2-3	4-5	4	3	5-6	4	4	6-7	3	4	5-6	1	4
4	5	2	5	4-5	2-3	5	5	3	7	5	4	6	5	4	7↑	2	3-4
6	4	2-3	8	3-4	3	5	2	3-4	7	5	4-5	-	-	-	-	-	-
6	3-4	1-2	7	3-4	2-3	6	1	2-3	8	5	4	7	5	3-4	4	1	5
6-7	5	2	6-7	4	3	3-4	4-5	3-4	8	5	4	8	5	4	3-4	2-3	3
4	5	2	6	4	2-3	3-4	4	3	7	5	4	6-7	5	4	-	-	-
5	5	2	6	4	2-3	6	4-5	3	8	5	4	7-8	5	4	4	1	4
5-6	3-4	2	6-7	3	2-3	4	3-4	3	5-6	4	4	6	3	3-4	5-6	1	4
5	4	2	7	4	2	5	4	2-3	8	5	4	7-8	5	3-4	4-5	2-3	3-4
5	4	2	7	4	2	5	4	2-3	6	5	4	6-7	5	3-4	4-5	2	3-4
8	5	2	8	5	2-3	8	5	3	8	5	4	8	5	4	7↑	2	4
8	5	2-3	8	5	3-4	6-7	5	4	8	5	4-5	8	5	4-5	7↑	5	4-5
5-6	5	2-3	7	4	3-4	4	5	3-4	6	5	4-5	8	5	4-5	7↑	4-5	5
7-8	5	2	7	4	3	7	5	3-4	8	5	4-5	6-7	5	4-5	7↑	5	4
4-5	5	2	6	4	2-3	8	5	3	6-7	5	4	7	5	4	7↑	5	4
6	5	2	6-7	4	2-3	2	4	3	8	5	4	7-8	5	4	3	2	4
5-6	4-5	2	6-7	3-4	2-3	3-4	4	3	8	5	4	8	5	4	3-4	1	4-5
5-6	4-5	2	6-7	3-4	3	3-4	4	3	8	5	4	8	4-5	4	4	1	4-5
5-6	4-5	2	7	4	3	4-5	4-5	3	7-8	5	4	8	5	4	4-5	2-3	4
5-6	4-5	2	7-8	4	2	5	5	3	8	5	4	8	5	3-4	6-7	2	3-4
3	5	3	1	4	4	1	4	4	4	5	4-5	6	5	4-5	3↓	4	5
7	4-5	4-5	6	4	4-5	5-6	3	4-5	8	4-5	4-5	7	2-3	4	4-5	2-3	4-5
7-8	4	3	7	3-4	4-5	6	3-4	4-5	5	4	4-5	7	4-5	4	4-5	3	4-5
7-8	3-4	3-4	6-7	3-4	4-5	6	3-4	4-5	8	4	4-5	7	4	4	4-5	2-3	4-5
7-8	3-4	4	6	3	4	3	2-3	4	8	5	4-5	7	2-3	4	3	2-3	4
3			3	1-2	1				3-4	5	4	1	2-3	2-3	-	-	-
6			4	1-2	4				5	5	4-5	5	2-3	2-3	-	-	-
6			4	1-2	4				5	5	4-5	5	2-3	2-3	-	-	-