

F-CLEAN®

Bringing the sunshine inside



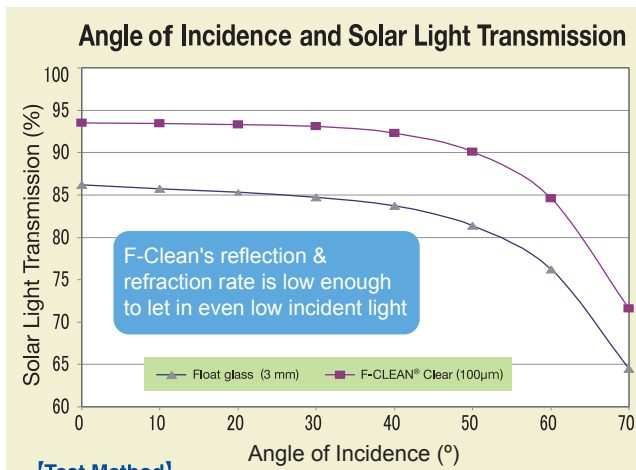
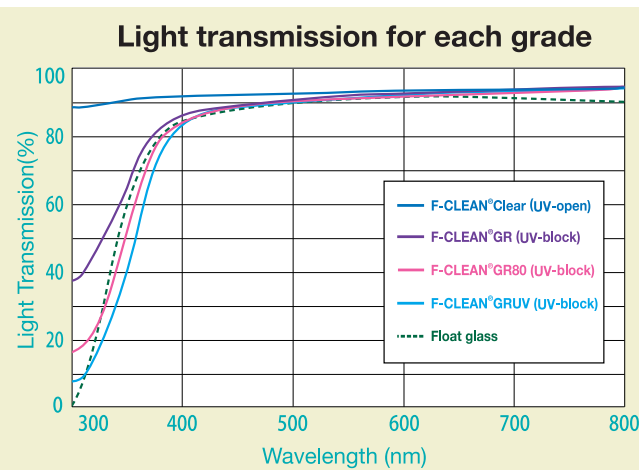
F-CLEAN® Clear

Bringing the sunshine inside

Function

- F-CLEAN® Clear enables extremely high light transmission.
- It has the highest UV transmission of all greenhouse covering materials.
- It takes the full spectrum of solar light resulting in healthy crops and vivid colours.
- It has excellent light transmission at all angles of incidence.

Performance



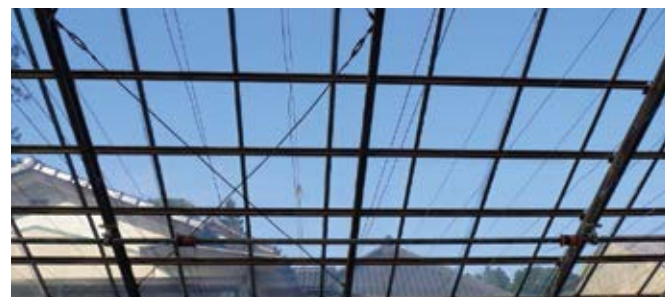
[Test Method]

1. Measure all spectrums (diffused and direct light) in wavelength region 300nm-2100nm
2. Calculate the rate of light transmission by measuring result of 1 based on JIS-R3106

Excellent durability



60μm thick F-Clean® installed in the Aichi region of Japan in 1988 (photographed 2009)



60μm thick F-Clean® installed in the Ibaraki region of Japan in 1988 (photographed 2010)

Applications

- For crops requiring anthocyanin such as aubergines and strawberries
- For greenhouses growing high quality and/or high added value crops
- For compost houses (animal manure and food leftovers)
- For drying houses (e.g. salt, fish and plums)
- To improve honeybee pollination



Projects

For better colour and the prevention of internode elongation.



Seedlings



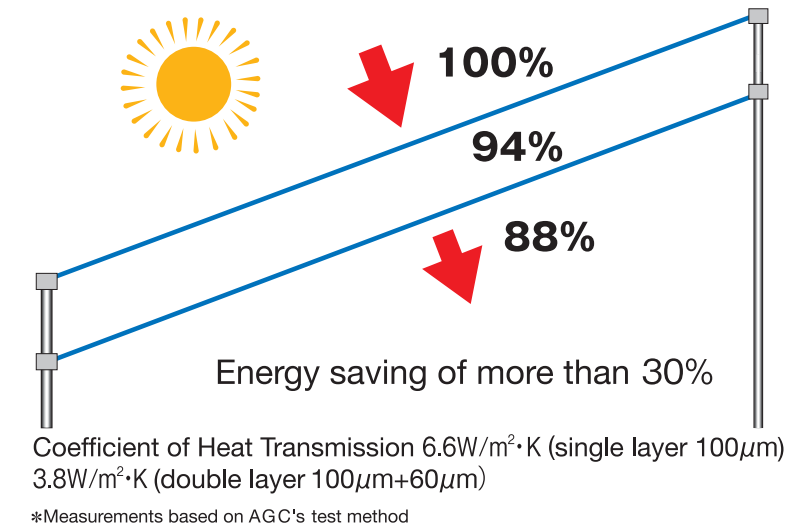
Aubergines



Strawberries

Double Layer Projects

Provides very high thermal insulation and light transmission.



Projects for non-agricultural applications



Fermenting houses for composting



Hothouses for drying fruit



Hothouses for drying plums

AGC GREEN-TECH CO., LTD.
www.f-clean.com

European office
World Trade Center, Zuidplein 80 1077 XV
Amsterdam, The Netherlands Tel: +31 20 880 4170
www.agcce.com

AGC Green-Tech Co., Ltd.
3-5-8 Iwamoto-cho Chiyoda-ku, Tokyo 101-0032
Japan Tel: +81-3-5833-5451

AGC Chemicals Americas, Inc.
55 E. Uwchlan Avenue, Suite 201 Exton, PA 19341 USA
Tel: +1 610-423-4300
www.agcchem.com

AGC Chemicals Asia Pacific Pte. Ltd.
460 Alexandra Road, 30-02 PSA Building,
Singapore 119963 Tel: +65-6273-5656

AGC Chemicals Trading (Shanghai) Co., Ltd
Room 2701-2705, Metro Plaza, 555 Lou Shan Guan Road,
Chang Ning Ward, Shanghai, China Post Code: 200051
Tel: +86-21-6386-2211

F-CLEAN® Diffused Series

A fluorine film which diffuses light evenly

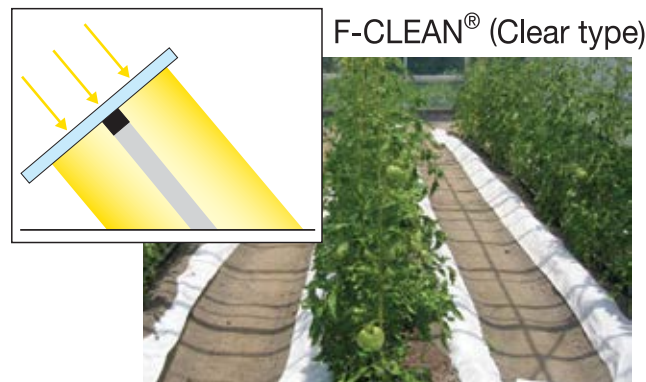
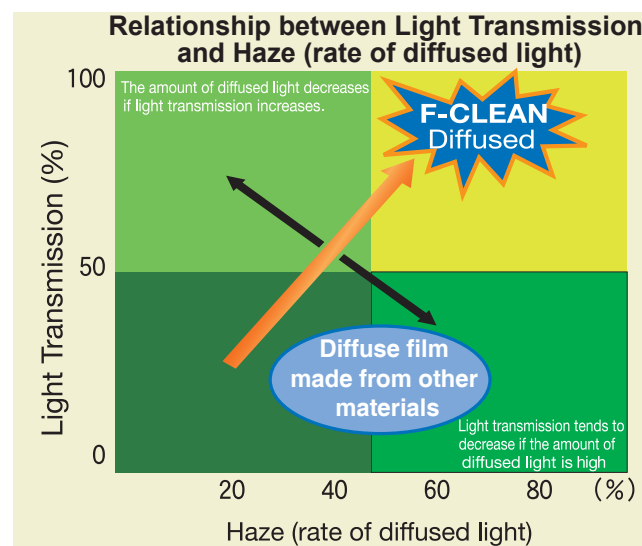
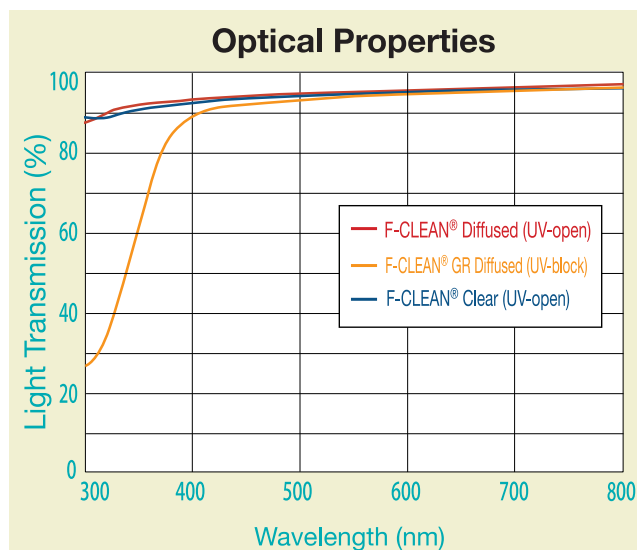
Function

- F-CLEAN® Diffused Series diffuses light evenly, eliminating shadows.
- The haze of F-CLEAN® Diffused is extremely high at 60-70 %.
(If condensation appears on the matte surface, the direct light tends to increase.)
- F-CLEAN® Diffused film enables more photosynthesis on every leaf.

Grades

- Available in two grades: Clear and GR (mild UV cut)

Performance

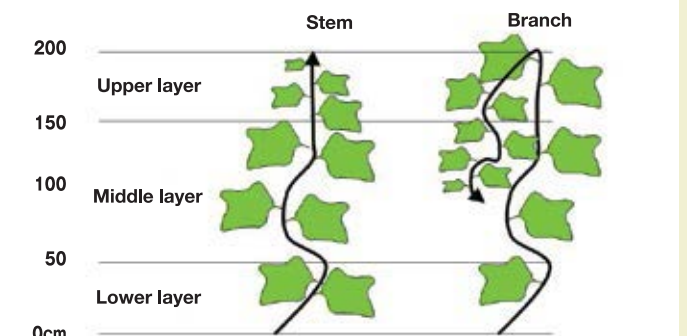
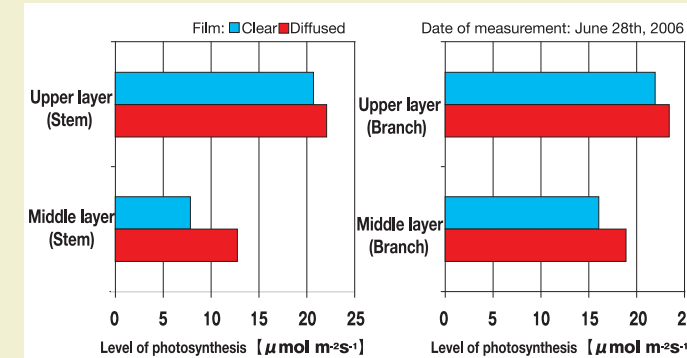


Tests done by independant research institute



Cooperation: Wageningen University (Dutch agricultural research organization)

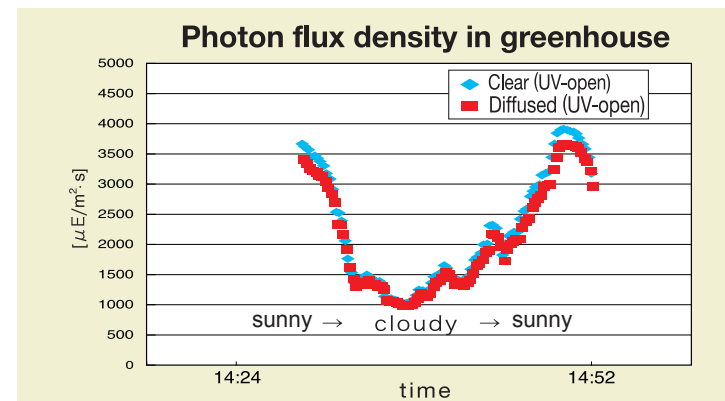
Comparisons between levels of photosynthesis (Crop: Cucumbers)



Greenhouses with diffused film recorded a 4.3% increase in yield and a 7.8% increase in numbers compared to greenhouses with clear film from April to July 2006.

Photometer data

Location of measurement: Kochi, Nankoku-shi, Japan. Date of measurement: July 3rd, 2008



The photometer results show no difference in photon levels of clear film and diffused film whether the weather is sunny or cloudy.

Photometer: Equipment which measures light transmission of photon with an angle of incidence of 270°

Projects



Grade : 60μm Diffused
Crop : Strawberries
Place : Tochigi



Grade: 80μm GR Diffused
Crop : Chrysanthemums
Place: Ibaraki



Grade: 80μm GR Diffused
Crop : Tomatoes
Place: Aichi

Note: The benefits of F-CLEAN® Diffused may not be maximized with certain conditions or crops. For more information, please contact your local sales office.

AGC GREEN-TECH CO., LTD.
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Amsterdam, The Netherlands Tel: +31 20 880 4170
www.agcce.com

AGC Green-Tech Co., Ltd.
3-5-8 Iwamoto-cho Chiyoda-ku, Tokyo 101-0032
Japan Tel: +81-3-5833-5451

AGC Chemicals Americas, Inc.
55 E. Uwchlan Avenue, Suite 201 Exton, PA 19341 USA
Tel: +1 610-423-4300
www.agchem.com

AGC Chemicals Asia Pacific Pte. Ltd.
460 Alexandra Road, 30-02 PSA Building,
Singapore 119963 Tel: +65-6273-5656

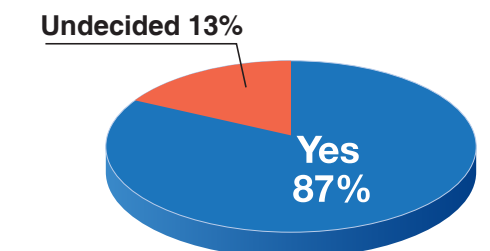
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Room 2701-2705, Metro Plaza, 555 Lou Shan Guan Road,
Chang Ning Ward, Shanghai, China Post Code: 200051
Tel: +86-21-6386-2211

Customer Satisfaction Survey

Survey date: 2008

Opinion of diffused film customers

Q: Would you choose F-CLEAN® Diffused again?



The light from F-CLEAN® Diffused is ideal for crops and humans. As a result, project numbers increase year on year.

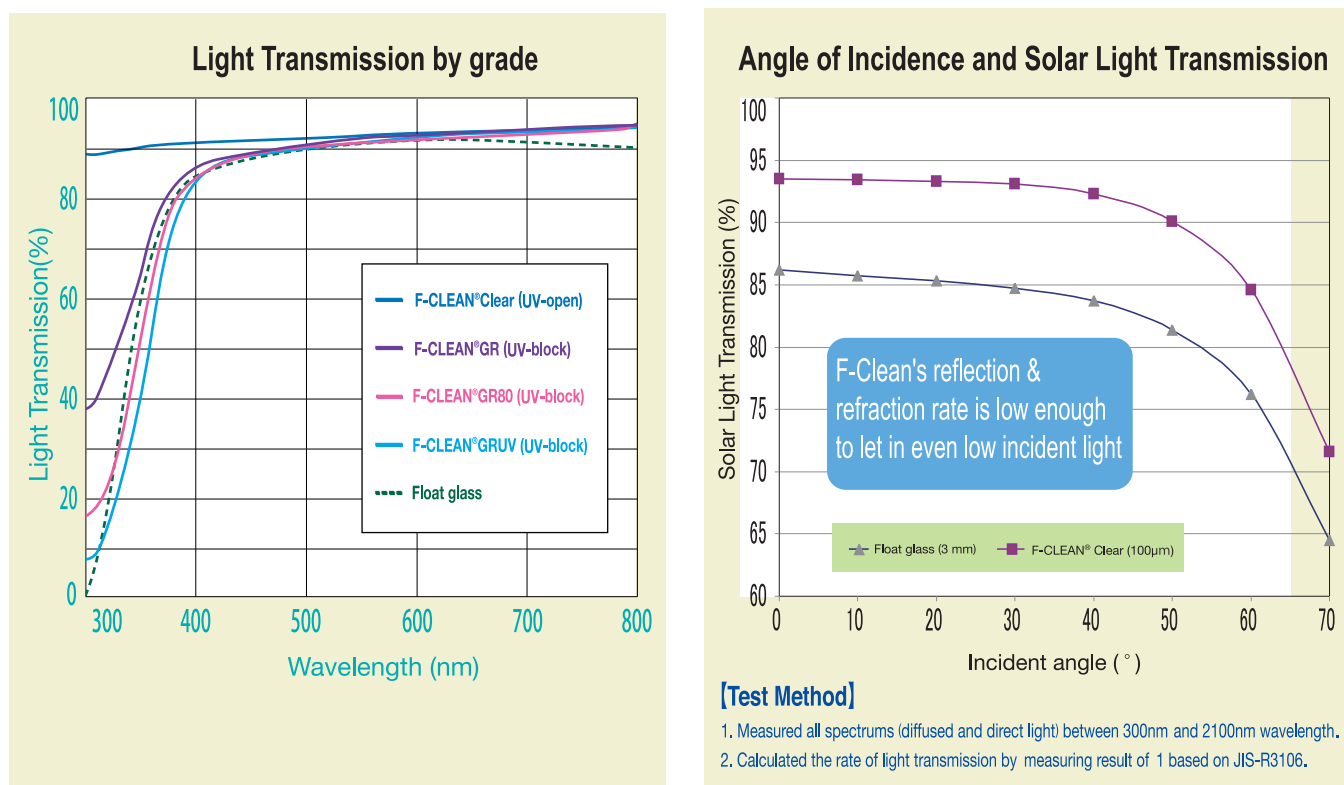
F-CLEAN® GR series

UV Cut Grades

Function

- There are three types of UV cut film available to suit the needs of different plant types.
- The UV cut grade also helps to protect materials and tools inside the greenhouse from UV damage.
- The UV cut function is long-lasting.

Performance



F-CLEAN®GR

F-CLEAN®GR provides low UV cut (Clear/Diffused)

F-CLEAN®GR80

UV cut properties similar to Glass (Clear)

F-CLEAN®GRUV

Highest UV cut in F-CLEAN series (Clear)

Example Projects

GR

Cyclamens



Melons



Grower's opinion

- GR cuts UV slightly, it encourages the growth of crops (Chiba Prefecture, Japan: pot plants)
- Growing time is reduced. (Aichi Prefecture, Japan: chrysanthemums)

GR80

Tomatoes



Spray Chrysanthemums



Grower's opinion

- High light transmission in Winter enables increased yields compared to when other covering materials are used. (Fukuoka Prefecture, Japan: tomatoes)
- The UV cut is ideal for both crops and workers.

GRUV

Roses



Rose House



Grower's opinion

- Increased winter yields (Oita prefecture, Japan: Roses)
- Improved rose quality and also increased number of flower heads due to improved new shoot growth.

Trends

Level of F-Clean GR Series use: high medium low

Plant Type	GR	GR80	GRUV
Chrysanthemum			
Carnation			
Rose			
Gerbera			
Lily			
Eustoma			
Cyclamen			
Moth orchid			
Tomato			
Melon			
Perilla frutescens			
Cucumber			

Rate of UV-cut: low GR GR80 GRUV high

Points

- ◆ Honeybees may behave differently under UV cut conditions. Professional bee keeping advice should be sought.
- ◆ Care should be taken when using F-Clean® GR grade films if the colour of the crop relies on anthocyanin.

AGC GREEN-TECH CO., LTD.
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European office
World Trade Center, Zuidplein 80 1077 XV
Amsterdam, The Netherlands Tel: +31 20 880 4170
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AGC Green-Tech Co., Ltd.
3-5-8 Iwamoto-cho Chiyoda-ku, Tokyo 101-0032
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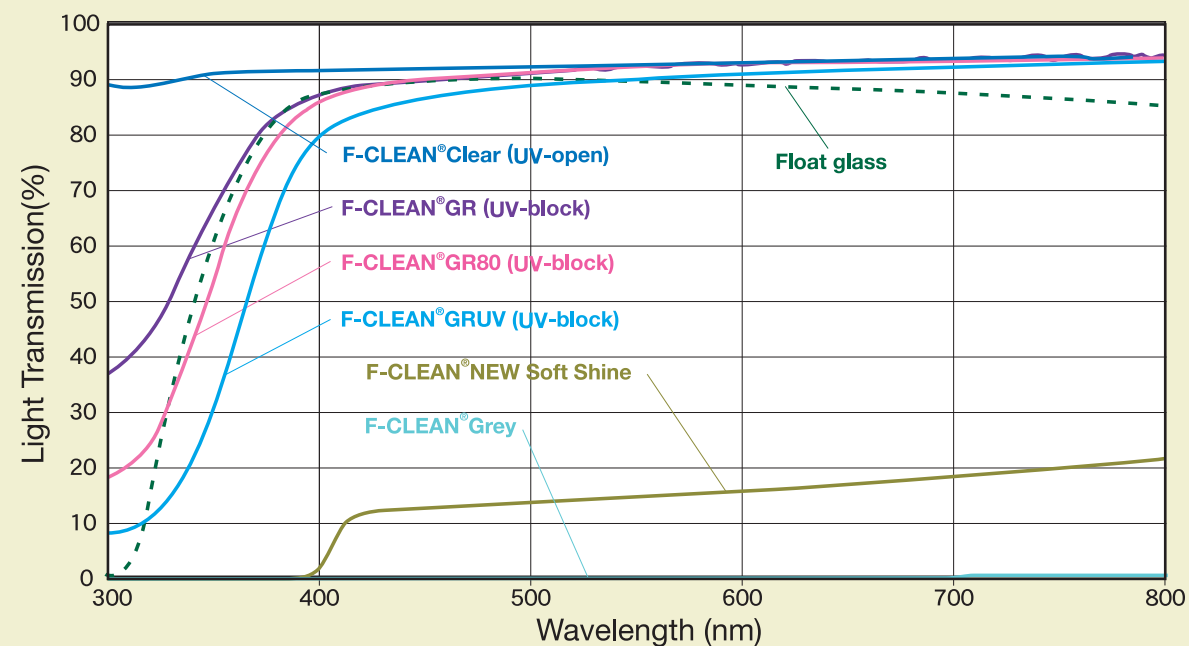
AGC Chemicals Americas, Inc.
55 E. Uwchlan Avenue, Suite 201 Exton, PA 19341 USA
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AGC Chemicals Asia Pacific Pte. Ltd.
460 Alexandra Road, 30-02 PSA Building,
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F-CLEAN® General Properties

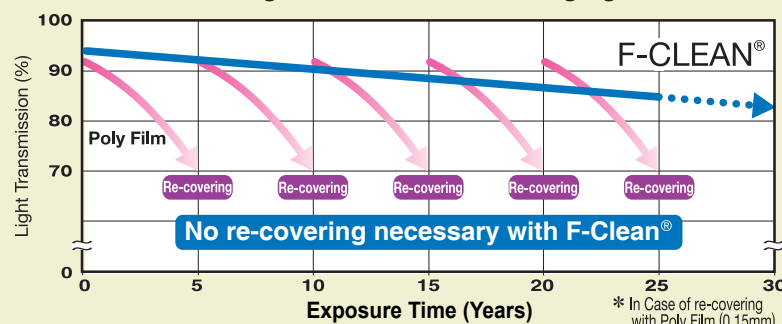
Light transmission by grade



Film thickness	Clear 60μm (UV-open)	Diffused 60μm (UV-open)	GR 60μm (UV-block)	GR80 80μm (UV-block)	GRUV 100μm (UV-block)	GR Diffused 80μm (UV-block)	NEW Soft shine 100μm	GREY 100μm
Light Transmission(%)	94	94	93	93	92	93	14	0
Transmission(%) at 300nm	89	88	38	18	8	28	0	0

* The statements and data given here are presented without any guarantee or warranty by AGC

Light Transmission with aging



* In Case of re-covering with Poly Film (0.15mm)

F-CLEAN® Expected durability

Thickness	Expected durability
50μm	~10 years
60μm	10~20 years
80μm	12~22 years
100μm	15~25 years
160μm	over 25 years

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Mechanical Properties

Items	Test Method	Unit	F-CLEAN® Clear 100μm	PET 150μm	Poly Film 150μm	PV 100μm
Tensile Strength	JIS K7127	MPa	60	230	35	25
Tensile Elongation	JIS K7127	%	406	81	600	340
Elmendorf's Tear Resistance	JIS K7128	N	21	1	10	9
Right Angle Tear Resistance	JIS K7128	N/mm	214	387	128	76

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Properties

Chemical Formula	$-(C_2H_4)_m-(C_2F_4)_n-$	Chemical Name	ETFE (Ethylene Tetrafluoroethylene copolymer)
Specific Gravity	1.75	Continuous Service Temperature	-100°C to +150°C
Melting Point	260°C	* Coefficient of Heat Transmission	6.6W/m ² ·K(1 layer 100μm) 3.8W/m ² ·K(2 layers 100μm+60μm)
Coefficient of liner Expansion	0.01%/°C	Fire Proof Test	JIS A 1322 Class 1 (Flame Proof)
Water Contact Angle (Surface Property)	100°	Chemical Resistance	F-Clean is not affected by strong acidity or strong alkalinity.

*Test method used by AGC

Grades

Grade Names	Characteristics
F-CLEAN® Clear	F-CLEAN® CLEAR takes full spectrums of solar light and provides light conditions the same as outside the greenhouse.
F-CLEAN® Diffused	F-CLEAN® Diffused provides highly diffused light while maintaining high light transmission.
F-CLEAN® GR series	F-CLEAN® GR series offers three grades with different rate of UV-cut as required.
F-CLEAN® GR Diffused	F-CLEAN® GR Diffused combines the properties of diffused film and UV cut film.
F-CLEAN® Grey	F-CLEAN® GREY cuts solar light up to 99%.
F-CLEAN® NEW Soft Shine	F-CLEAN® New Soft Shine cuts infrared rays but transmits light.

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European office
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Amsterdam, The Netherlands Tel: +31 20 880 4170
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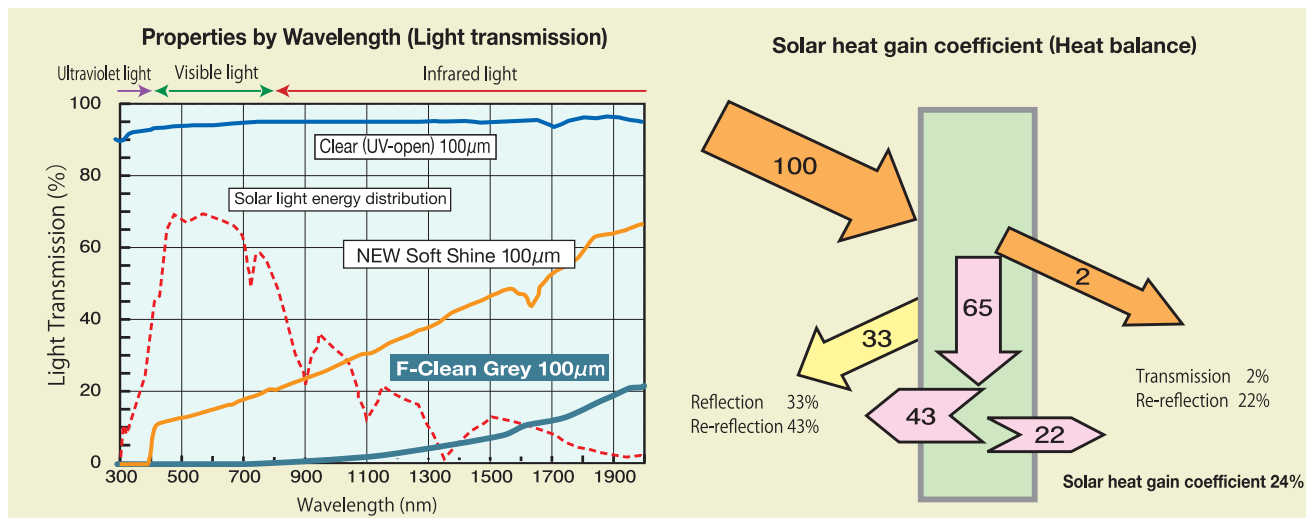
F-CLEAN® Grey

Grey film has a high light-filtering function to provide a cool environment in hot weather

Functions

- Cuts over 99% of visible light
- Blocks heat energy from solar light and prevents the internal temperature from rising. (solar heat gain coefficient 24%, equivalent to F-CLEAN® New Soft Shine)
- Has excellent weatherability and chemical resistance.
- Absorption of infrared light is extremely high.
- More snow resistant than F-Clean® Clear.

Performance



Applications

- Animal housing
- Warehousing
- Pergolas, Shelters
- Mushroom cultivation
- Sports facilities
- Greenhouses
- Sewage disposal facilities



Typical application

Examples



Irrigation room



Machinery Warehouse



Animal housing
* covered with alternating clear and white film



Fish farm facility



Mushroom cultivation



Sewage disposal facility

Specification

- 100μm x 1300mm x 50m with anti-dripping treatment (Special repair tape is available for Grey film)

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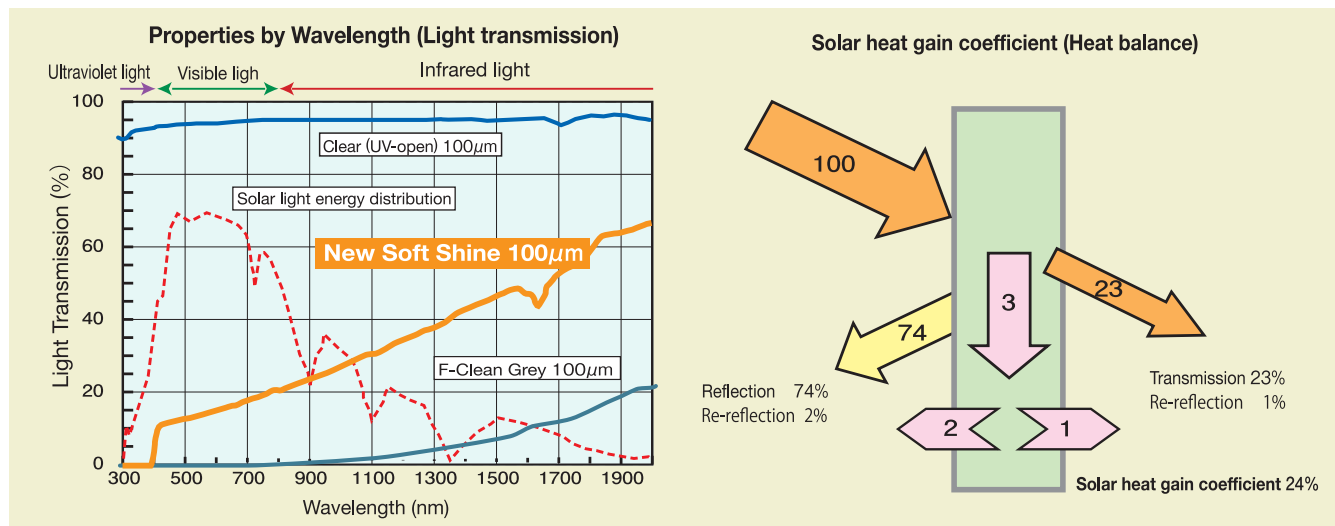
F-CLEAN® New Soft Shine

F-CLEAN® New Soft Shine cuts infrared rays while still transmitting light

Characteristics

- Enables light transmission of about 14%, whilst simultaneously blocking heat energy from solar light to prevent temperature build-up inside (Solar heat gain coefficient 24% equivalent to F-CLEAN®Grey)
- Excellent weatherability and chemical resistance
- Cuts UV completely

Performance



Applications

- Animal housing
- Sheds/Warehouses
- Pergolas/Shelters
- Mushroom Cultivation
- Greenhouses
- Sports facilities



Typical application

Examples

*These images show projects using original Soft Shine



Mushroom cultivation



Animal housing

* covered with alternating clear and white film



Shading for stores



Delivery facility



Swimming pool

* covered with alternating clear and white film



Delivery facility (Germany)

Specification

- 100μm x 1300mm x 50m with anti-dripping treatment

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F-CLEAN® Handling & Installing

Please read before installing F-CLEAN®

Caution



- DO NOT dispose of F-CLEAN® by burning.
This may release hazardous gases and fumes.
- Dispose of F-CLEAN® in cooperation with your local waste processing company. Check disposal methods with the appropriate regulatory authorities.

Pre-installation notice

- The side with the anti-dripping treatment should be installed towards the inside of the greenhouse and is marked with the text "INSIDE". Please note when installing.
 - Do not stand a box containing F-CLEAN® on its end.
 - Take personal safety precautions when lifting or moving F-CLEAN®.
- ① If F-CLEAN® is loosely fixed over a greenhouse, it may flap in windy conditions and come into repeated contact with the structure of the greenhouse. This may cause tearing after a period of time.
 - ② Fix F-CLEAN® to fixing profiles stretching the film tightly like the skin of a drum.
 - ③ F-CLEAN® should be applied using very high tension at low temperatures (as film tension may reduce as temperatures rise).
- Any rough or sharp part of structure that comes into contact with F-CLEAN® must be covered to avoid damaging F-CLEAN®.
 - Please ask greenhouse constructors about profiles (e.g. aluminium bars, rafters and screws) before making a choice.
 - Try to avoid touching the side of F-CLEAN® treated with anti-dripping treatment as it may reduce the anti-dripping properties.
 - Do not store flammable materials close to F-CLEAN® due to the possibility of static electricity.

Film maintenance and advice

- Damaged F-CLEAN® can be repaired using F-CLEAN® repair tape.
- Make sure the space around the damage is clean and dry (use a soft cloth) before repairing.
- Heating the area with hot air after applying the repair tape (i.e. using an industrial dryer) could strengthen the adhesivity of the repair tape. (F-CLEAN® Repair Tape Specification: 50mm wide x 10m per roll)
- The anti-dripping characteristics of F-CLEAN® may reduce after years of use. If this happens it is possible to re-treat with a special spray to renew the anti-dripping coating.

Please use five to six 500ml bottles of F-CLEAN® anti-dripping treatment per 1,000m² greenhouse.
Soft water is required for dilution.
Dilution rate is 1:150.

- Take preventive measures against bird damage.
- F-CLEAN® may need to be cleaned depending on greenhouse location or internal conditions.
- If using spray shading liquid, please contact the manufacturer regarding suitability of use with F-CLEAN®.
Attaching could be difficult if shading liquid is applied to F-CLEAN® immediately after installation.
- Materials which contain titanium oxide (TiO₂) have a strong photocatalyst effect which may damage F-CLEAN®.

- Lens effect happens when solar light passes through drops of rainwater on film. This can cause a spark or melting of materials inside. Remove residual rainwater especially on ventilation windows.



Rainwater on ventilation window

- F-CLEAN® was designed for horticultural and industrial use.
Please contact us if you are considering the use of F-CLEAN® ETFE film for other applications.

Contact us for further information.



F-CLEAN® repair tape



Anti-dripping treatment for F-CLEAN®



Photocatalyst



Burned holes in ground sheet

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Tel: +86-21-6386-2211



AGC Green-Tech Co., Ltd. Worldwide Contacts

AGC Chemicals Europe
Commercial Centre
World Trade Center
Zuidplein 80
1077 XV Amsterdam,
Netherlands
Tel: +31 20 880 4170
Fax: +31 20 880 4188
www.agcce.com



AGC Green-Tech Co., Ltd.
3-5-8 Iwamoto-cho
Chiyoda-ku,
Tokyo 101-0032
Japan
Tel: +81-3-5833-5451
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AGC Chemicals Americas, Inc.
55 E. Uwchlan Avenue,
Suite 201
Exton, PA 19341
USA
Tel: +1 610-423-4300
Fax: +1 610-423-4301
www.agcchem.com

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Room 2701-2705,
Metro Plaza,
555 Lou Shan Guan Road,
Chang Ning Ward,
Shanghai,
China Post Code: 200051
Tel: 86-21-6386-2211
Fax: 86-21-6386-5377 / 5378
www.agcsh.com

AGC Chemicals Asia Pacific Pte. Ltd.
460 Alexandra Road,
30-02 PSA Building,
Singapore 119963
Tel: +65-6273-5656
Fax: +65-6276-8783

