

ENVIRONMENTAL PROTECTION AGENCY
40 CFR Part 82

[FRL-6503-7]

Protection of Stratospheric Ozone

AGENCY: Environmental Protection Agency.

ACTION: Notice of acceptability.

SUMMARY: This document expands the list of acceptable substitutes for ozone-depleting substances (ODS) under the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program.

EFFECTIVE DATE: December 6, 1999.

ADDRESSES: Information relevant to this document is contained in Air Docket A-91-42, Central Docket Section, South Conference Room 4, U.S. Environmental Protection Agency, 401 M Street, S.W., Washington, D.C. 20460, telephone: (202) 260-7548. The docket may be inspected between 8:00 a.m. and 5:30 p.m. weekdays. As provided in 40 CFR part 2, a reasonable fee may be charged for photocopying.

FOR FURTHER INFORMATION CONTACT: Kelly Davis at (202) 564-2303 or fax (202) 565-2096, davis.kelly@epa.gov, U.S. Environmental Protection Agency, Stratospheric Protection Division, Mail Code 6205J, Washington, D.C. 20460. Overnight or courier deliveries should be sent to the office location at 501 3rd Street, NW, Washington, DC, 20001. The Stratospheric Protection Hotline at (800) 296-1996. EPA's Ozone Depletion World Wide Web site at "<http://www.epa.gov/ozone/title6/snap/>".

SUPPLEMENTARY INFORMATION:

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Appendix A—Summary of Acceptable Decisions
I. Section 612 Program
A. Statutory Requirements

Section 612 of the Clean Air Act authorizes EPA to develop a program for evaluating alternatives to ozone-depleting substances. EPA refers to this program as the Significant New Alternatives Policy (SNAP) program. The major provisions of section 612 are:

- **Rulemaking**—Section 612(c) requires EPA to promulgate rules making it unlawful to replace any class

I (chlorofluorocarbon, halon, carbon tetrachloride, methyl chloroform, methyl bromide, and hydrobromofluorocarbon) or class II (hydrochlorofluorocarbon) substance with any substitute that the Administrator determines may present adverse effects to human health or the environment where the Administrator has identified an alternative that (1) reduces the overall risk to human health and the environment, and (2) is currently or potentially available.

- Listing of Unacceptable/Acceptable Substitutes—Section 612(c) also requires EPA to publish a list of the substitutes unacceptable for specific uses. EPA must publish a corresponding list of acceptable alternatives for specific uses.

• *Petition Process*—Section 612(d) grants the right to any person to petition EPA to add a substance to or delete a substance from the lists published in accordance with section 612(c). The Agency has 90 days to grant or deny a petition. Where the Agency grants the petition, EPA must publish the revised lists within an additional 6 months.

• *90-day Notification*—Section 612(e) requires EPA to require any person who produces a chemical substitute for a class I substance to notify the Agency not less than 90 days before new or existing chemicals are introduced into interstate commerce for significant new uses as substitutes for a class I substance. The producer must also provide the Agency with the producer's unpublished health and safety studies on such substitutes.

• *Outreach*—Section 612(b)(1) states that the Administrator shall seek to maximize the use of federal research facilities and resources to assist users of class I and II substances in identifying and developing alternatives to the use of such substances in key commercial applications.

• *Clearinghouse*—Section 612(b)(4) requires the Agency to set up a public clearinghouse of alternative chemicals, product substitutes, and alternative manufacturing processes that are available for products and manufacturing processes which use class I and II substances.

B. Regulatory History

On March 18, 1994, EPA published rulemaking (FRM) (59 FR 13044) which described the process for administering the SNAP program and issued EPA's first acceptability lists for substitutes in the major industrial use sectors. These sectors include: refrigeration and air conditioning; foam blowing; solvents cleaning; fire suppression and explosion protection; sterilants; aerosols;

adhesives, coatings and inks; and tobacco expansion. These sectors compose the principal industrial sectors that historically consumed the largest volumes of ozone-depleting compounds.

As described in the original rule for the SNAP program (59 FR 13044; March 18, 1994), EPA does not believe that rulemaking procedures are required to list alternatives as acceptable with no limitations. Such listings do not impose any sanction, nor do they remove any prior license to use a substance. Consequently, by this notice EPA is adding substances to the list of acceptable alternatives without first requesting comment on new listings.

EPA does, however, believe that Notice-and-Comment rulemaking is required to place any substance on the list of prohibited substitutes, to list a substance as acceptable only under certain conditions, to list substances as acceptable only for certain uses, or to remove a substance from either the list of prohibited or acceptable substitutes. Updates to these lists are published as separate notices of rulemaking in the **Federal Register**.

The Agency defines a "substitute" as any chemical, product substitute, or alternative manufacturing process, whether existing or new, that could replace a class I or class II substance. Anyone who produces a substitute must provide the Agency with health and safety studies on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative. This requirement applies to substitute manufacturers, but may include importers, formulators or end-users, when they are responsible for introducing a substitute into commerce.

EPA published Notices listing acceptable alternatives on August 26, 1994 (59 FR 44240), January 13, 1995 (60 FR 3318), July 28, 1995 (60 FR 38729), February 8, 1996 (61 FR 4736), September 5, 1996 (61 FR 47012), March 10, 1997 (62 FR 10700), June 3, 1997 (62 FR 30275), February 24, 1998 (63 FR 9151), May 22, 1998 (63 FR 28251), and June 8, 1999 (64 FR 30410), and published Final Rulemakings restricting or prohibiting the use of certain substitutes on March 18, 1994 (59 FR 13044), June 13, 1995 (60 FR 31092), May 22, 1996 (61 FR 25585), October 16, 1996 (61 FR 54029), January 26, 1999 (64 FR 3861 and 3865), March 3, 1999 (64 FR 10374), April 28, 1999 (64 FR 22981), and June 8, 1999 (64 FR 30410).

II. Listing of Acceptable Substitutes

This section presents EPA's most recent acceptable listing decisions for substitutes for class I and class II substances in the refrigeration and air

conditioning, foam blowing, solvents cleaning, and aerosols sectors. For copies of the full list of SNAP decisions in all industrial sectors, contact the EPA Stratospheric Protection Hotline at (800) 296-1996.

Parts A–D below present a detailed discussion of the substitute listing. The table summarizing today's listing decisions is in Appendix A. The comments contained in Appendix A provide additional information, but are not legally binding under section 612 of the Clean Air Act. Thus, adherence to recommendations in the comments is not mandatory for use of a substitute. In addition, the comments should not be considered comprehensive with respect to other legal obligations pertaining to the use of the substitute. However, EPA strongly encourages users of acceptable substitutes to apply all comments to their use of these substitutes. In many instances, the comments simply refer to standardized operating practices that have already been identified in existing industry and/or building-code standards. Thus, many of the comments, if adopted, would not require significant changes in existing operating practices for the affected industry.

A. Refrigeration and Air Conditioning

1. Acceptable Substitutes

Under section 612 of the Clean Air Act, EPA is authorized to review substitutes for class I (CFC) and class II (HCFC) chemicals. The decisions set forth in this section expand the acceptable listing for refrigerants.

In listing these refrigerants as acceptable, EPA anticipates that these refrigerants will be used in such a manner so that any recommendations specified in the manufacturers' Material Safety Data Sheets (MSDSs) are followed. EPA also anticipates that manufacturers, installers, servicers, building owners and other parties responsible for construction and maintenance of refrigeration and air-conditioning systems will follow all applicable standard industry practices and technical standards established by voluntary consensus standards organizations such as the American National Standards Institute (ANSI). The Agency also expects that refrigerating systems will conform to all relevant provisions of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards, including Standard 15, Safety Code for Mechanical Refrigeration, which provides guidelines for the safety of persons and property on or near premises where refrigeration facilities are located. Finally, the Agency

anticipates that any exposures by installers or servicers to refrigerants will conform to all applicable standards set by the U.S. Occupational Safety and Health Administration (OSHA) and will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association's (AIHA) workplace environmental exposure limits (WEELs).

(a) *THR-02. The chemical blend submitted to EPA with the unregistered trade name THR-02 is acceptable as a substitute for CFC-12 in the following end-uses:*

- Industrial process refrigeration and air-conditioning.
- Cold storage warehouses.
- Refrigerated transport.
- Retail food refrigeration.
- Ice machines.
- Vending machines.
- Water coolers.
- Centrifugal chillers.
- Reciprocating chillers.
- Household refrigerators and freezers.

Tsinghua University of Beijing and the Beijing Inoue Qinghua Refrigeration Technology Company LTD, the joint submitters of THR-02, claim that its composition is confidential business information. Fractionation and flammability testing have determined that although two constituents of the blend are flammable, THR-02 as blended is not, and further testing has shown that it does not become flammable after leakage. The blend does not contain any significant ozone depleters. THR-02 contains a constituent with a low global warming potential (GWP). The potential of this constituent for contributing to global warming will be mitigated in each end-use through the implementation of the venting prohibition under section 608(c)(2) of the Clean Air Act.

(b) *THR-03. The chemical blend submitted to EPA with the unregistered trade name THR-03 is acceptable as a substitute for HCFC-22 in the following end-uses:*

- Industrial process refrigeration and air-conditioning.
- Cold storage warehouses.
- Refrigerated transport.
- Retail food refrigeration.
- Ice machines.
- Centrifugal chillers.
- Reciprocating chillers.
- Ice skating rinks.
- Household refrigerators and freezers.

- Residential window unit air-conditioning.

Tsinghua University of Beijing and the Beijing Inoue Qinghua Refrigeration Technology Company LTD, the joint submitters of THR-03, claim that its composition is confidential business information. Fractionation and flammability testing have determined that although one constituent of the blend is flammable, THR-03 as blended is not, and further testing has shown that it does not become flammable after leakage. The blend has virtually no ozone depleting potential. THR-03 contains two constituents with moderate global warming potentials (GWP). The potential of these constituents for contributing to global warming will be mitigated in each end-use through the implementation of the venting prohibition under section 608(c)(2) of the Clean Air Act.

(c) *ISCEON 59. The chemical blend submitted to EPA with the unregistered trade name ISCEON 59 is acceptable as a substitute for R-22 in the following end-uses:*

- Household and light commercial air-conditioning.
- Commercial comfort air-conditioning.
- Industrial process refrigeration and air-conditioning.
- Cold storage warehouses.
- Refrigerated transport.
- Retail food refrigeration.
- Ice machines.
- Vending machines.
- Water coolers.
- Centrifugal chillers.
- Reciprocating chillers.
- Household and other refrigerated appliances.
- Ice skating rinks.
- Non-mechanical heat transfer.

ISCEON 59 contains HFC-125, HFC-134a, and a small amount of n-butane. HFC-125 and HFC-134a exhibit a fairly high global warming potential (3,400 and 1,900, respectively, over a 100 year integrated time horizon) compared to HCFC-22 (1,750 over a 100 year integrated time horizon). However, the potential of these constituents for contributing to global warming will be mitigated in each end-use through the implementation of the venting prohibition under section 608(c)(2) of the Clean Air Act. ISCEON 59 does not contain ozone-depleting substances and is low in toxicity. Although n-butane is flammable, the blend is not. Leak testing has demonstrated that its composition should never become flammable under the expected conditions in the listed end-uses.

(d) *Ikon® B. Ikon® B, a blend of trifluoriodomethane (CF₃I), HFC-134a*

and HFC-152a, is acceptable as a substitute for CFC-12 in the following end-uses:

- Industrial process refrigeration and air-conditioning.
- Cold storage warehouses.
- Refrigerated transport.
- Retail food refrigeration.
- Ice machines.
- Vending machines.
- Water coolers.
- Centrifugal chillers.
- Reciprocating chillers.
- Residential dehumidifiers.

Fractionation and flammability testing have determined that although HFC-152a is flammable, Ikon® B as blended is not, and further testing has shown that it does not become flammable after leakage. Ikon® B has virtually no ozone depleting potential. It contains two constituents with moderate global warming potentials (GWP). The potential of these constituents for contributing to global warming will be mitigated in each end-use through the implementation of the venting prohibition under section 608(c)(2) of the Clean Air Act.

(e) Cryo-Mechanical® Cryogenic Transport Refrigeration System. *The cryo-mechanical® cryogenic transport system that uses recaptured and recycled liquid carbon dioxide or liquid nitrogen is acceptable as a substitute for R-502 or CFC-12 in the transport refrigeration end-use.* The cryo-mechanical® cryogenic transport system replaces the conventional engine and compressor in a transport refrigeration system by using the energy from evaporating and expanding liquid CO₂ or N₂. The CO₂ or N₂ expands through the system coils and powers a vapor motor, which then powers an evaporator blower and an alternator. The evaporator blower forces cargo space air through the system coils where it is cooled down and subsequently propelled back into the cargo space. The CO₂/N₂ vapors are released into the atmosphere without ever entering the cargo space. Since the system does not require the use of the conventional diesel engine, emissions of combustion products such as NO_x, SO₂, and CO₂ are avoided.

(f) HFE-7200. *Hydrofluoroether (HFE-7200) (C₄F₉OC₂H₅;* ethoxynonafluorobutane, iso and normal) is an acceptable substitute for CFC-113 in non-mechanical heat transfer. HFE-7200 does not delete the ozone layer since it does not contain chlorine or bromine. It has a 0.9 year atmospheric lifetime and a GWP of 100 over a 100-year time horizon. The GWP and lifetime for this HFE are lower than the GWP and lifetime for CFC-113.

B. Foam Blowing

1. Acceptable Substitutes

(a) HFC-245fa. *HFC-245fa is acceptable as a substitute for CFC-11 and HCFC-141b in all foam end-uses.* HFC-245fa contains no chlorine or bromine; therefore, it has zero ODP. Its 100-year GWP is 1022. HFC-245fa is non-flammable. EPA anticipates that HFC-245fa will be used in such a manner so that any recommendations specified in the manufacturers' Material Safety Data Sheets (MSDSs) are followed. The Agency also expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association's (AIHA) workplace environmental exposure limits (WEELs).

(b) Exxsol Blowing Agents. *Exxsol Blowing Agents are acceptable substitutes for HCFC-141b in all foam end-uses.* C₃-C₆ saturated light hydrocarbons are already acceptable substitutes for CFC-11 and HCFC-141b in several foam end-uses. Exxsol blowing agents are hydrocarbon (pentane) blends that have no ozone depletion potential, low global warming potentials, and are low in toxicity. However, these agents are flammable and should be handled with proper precautions.

The flammability of hydrocarbon blowing agents, including Exxsol, are of particular concern in spray foam applications where a controlled factory environment is not possible. The manufacturer and supplier of Exxsol blowing agents, Exxon, has performed several studies showing that under normal circumstances flammable concentrations do not occur in spray foam applications (Docket A-91-42, Category IX-B, Background Documents for Notice 11). However, without adequate ventilation, several situations could lead to explosion or fire. Examples include, but are not limited to, equipment wells on roofs, roofs enclosed by high parapet walls, and interior applications (especially where a basement or other confined space is beneath the spray area). Therefore, it is critical that application in enclosed areas be accompanied by adequate forced ventilation, flammable vapor monitoring and the elimination of all possible ignition sources.

The potential for explosion or fire highlights the need for safety training. Exxon will sell Exxsol blowing agents only to systems manufacturers who

have contractually guaranteed to provide training on safe storage, handling and application to their customers, contractors, and applicators. Draft training materials have been provided to EPA and are available through the Air Docket (Docket A-91-42, Category IX-B, Background Documents for Notice 11). Exxon has also offered to work with trade groups to develop additional training. While training can not provide an absolute guarantee of safety, EPA believes that a comprehensive training program, if implemented properly, can adequately control risks associated with use of potentially flammable pentane-blown spray foam systems.

Because manufacturers of other hydrocarbon blowing agents have not ensured adequate training, today's listing does not extend to hydrocarbons as a class. If other manufacturers are interested in Exxon's approach, they should contact EPA.

C. Solvents Cleaning

1. Acceptable Substitutes

(a) HFE-7200. *Hydrofluoroether (HFE-7200): (C₄F₉OC₂H₅;* ethoxynonafluorobutane, iso and normal) is an acceptable substitute for CFC-113 and methyl chloroform (MCF) in all solvents cleaning end-uses. This chemical does not deplete the ozone layer since it does not contain chlorine or bromine. It has a 0.9 year atmospheric lifetime and a GWP of 100 over a 100-year time horizon. EPA anticipates that HFE-7200 will be used in such a manner so that any recommendations specified in the manufacturers' Material Safety Data Sheets (MSDSs) are followed. The Agency also expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association's (AIHA) workplace environmental exposure limits (WEELs).

D. Aerosols

1. Acceptable Substitutes

(a) HFE-7200. *Hydrofluoroether (HFE-7200): (C₄F₉OC₂H₅;* ethoxynonafluorobutane, iso and normal) is an acceptable substitute for CFC-113 and methyl chloroform (MCF) as a solvent in aerosol products. This chemical does not deplete the ozone layer since it does not contain chlorine or bromine. It has a 0.9 year atmospheric lifetime and a GWP of 100 over a 100-year time horizon. EPA

anticipates that HFE-7200 will be used in such a manner so that any recommendations specified in the manufacturers' Material Safety Data Sheets (MSDSs) are followed. The Agency also expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association's (AIHA) workplace environmental exposure limits (WEELs).

III. Additional Information

Contact the Stratospheric Protection Hotline at (800) 296-1996, Monday–Friday, between the hours of 10:00 a.m. and 4:00 p.m. (EST). For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the SNAP final rulemaking published in the **Federal Register** on March 18, 1994 (59 FR 13044). Notices and rulemakings under the SNAP program, as well as all EPA publications on protection of stratospheric ozone, are available from EPA's Ozone Depletion

World Wide Web site at "http://www.epa.gov/ozone/title6/snap/" and from the Stratospheric Protection Hotline whose number is listed above.

List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control, Reporting and recordkeeping requirements.

Dated: November 24, 1999

Paul Stolpman,

*Director, Office of Atmospheric Programs,
Office of Air and Radiation.*

APPENDIX A: SUMMARY OF ACCEPTABLE DECISIONS

End-use	Substitute	Decision	Comments
REFRIGERATION and AIR CONDITIONING SECTOR			
The following CFC-12 end-uses: • Industrial process refrigeration and air-conditioning • Cold storage warehouses • Refrigerated transport • Retail food refrigeration • Ice machines • Vending machines • Water coolers • Centrifugal chillers • Reciprocating chillers • Household refrigerators and freezers	THR-02	Acceptable	EPA expects that manufacturers, installers and servicers of refrigeration and air-conditioning systems will follow all applicable industry practices and technical standards, including but not limited to standards issued by the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), and that exposures will be kept within all applicable American Industrial Hygiene Association (AIHA) and American Conference of Governmental Industrial Hygienists (ACGIH) occupational exposure limits.
The following HCFC-22 end-uses: • Industrial process refrigeration and air-conditioning • Cold storage warehouses • Refrigerated transport • Retail food refrigeration • Ice machines • Centrifugal chillers • Reciprocating chillers • Ice skating rinks • Household refrigerators and freezers • Window-unit residential air conditioners	THR-03	Acceptable	EPA expects that manufacturers, installers and servicers of refrigeration and air-conditioning systems will follow all applicable industry practices and technical standards, including but not limited to standards issued by the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), and that exposures will be kept within all applicable American Industrial Hygiene Association (AIHA) and American Conference of Governmental Industrial Hygienists (ACGIH) occupational exposure limits.
The following HCFC-22 end-uses: • Household and light commercial air-conditioning • Commercial comfort air-conditioning • Industrial process refrigeration and air-conditioning • Cold storage warehouses • Refrigerated transport • Retail food refrigeration • Ice machines • Vending machines • Water coolers • Centrifugal chillers • Reciprocating chillers • Household and other refrigerated appliances • Ice skating rinks • Non-mechanical heat transfer	ISCEON 59	Acceptable	EPA expects that manufacturers, installers and servicers of refrigeration and air-conditioning systems will follow all applicable industry practices and technical standards, including but not limited to standards issued by the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), and that exposures will be kept within all applicable American Industrial Hygiene Association (AIHA) and American Conference of Governmental Industrial Hygienists (ACGIH) occupational exposure limits.

End-use	Substitute	Decision	Comments
The following CFC-12 end-uses: • Industrial process refrigeration and air-conditioning • Cold storage warehouses • Refrigerated transport • Retail food refrigeration • Ice machines • Vending machines • Water coolers • Centrifugal chillers • Reciprocating chillers • Residential dehumidifiers	Ikon® B	Acceptable	EPA expects that manufacturers, installers and servicers of refrigeration and air-conditioning systems will follow all applicable industry practices and technical standards, including but not limited to standards issued by the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE), and that exposures will be kept within all applicable American Industrial Hygiene Association (AIHA) and American Conference of Governmental Industrial Hygienists (ACGIH) occupational exposure limits.
The following R-502 or CFC-12 end-uses: • Refrigerated transport	Cryo-Mechanical® Cryogenic Transport Refrigeration System.	Acceptable	The Cryogenic transport system may use liquified nitrogen (N ₂) or carbon dioxide (CO ₂). EPA expects that suppliers of CO ₂ will not generate new CO ₂ for this system, but instead, use the CO ₂ that is commonly recovered, purified, and liquified from that otherwise released from existing industrial processes.
The following CFC-113 end-uses: • Non-mechanical heat transfer	HFE-7200	Acceptable	EPA expects that manufacturers, installers and servicers of refrigeration and air-conditioning systems will follow all applicable industry practices and technical standards.

FOAM BLOWING SECTOR

The following CFC-11 and HCFC-141b end-uses: • All foam end-uses	HFC-245fa	Acceptable	EPA's Office of Pollution Prevention and Toxics has reviewed the toxicity profile for HFC-245fa, and referred it to a WEEL committee for a final exposure limit.
The following HCFC-141b end-uses: • All foam end-uses	Exxsol Blowing Agents.	Acceptable	EPA expects that Exxon will work with its customers to ensure that they are aware of potential risks associated with Exxsol and that systems manufacturers provide adequate training on safe storage, handling and application to customers, contractors, and applicators. EPA also expects that Exxon will work with trade groups and continue to develop training materials as more information becomes available on the risks of hydrocarbons in spray foam applications.

SOLVENTS CLEANING SECTOR

The following CFC-113 and methyl chloroform end-uses: • All solvents cleaning end-uses	HFE-7200	Acceptable	The Agency expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association's (AIHA) workplace environmental exposure limits (WEELs).
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AEROSOL SECTOR

The following CFC-113 and methyl chloroform end-uses: • As a solvent in aerosol products	HFE-7200	Acceptable	The Agency expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists' (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association's (AIHA) workplace environmental exposure limits (WEELs).
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