Honeywell Solstice® yf

Guidelines for Use and Handling of Solstice® yf

Honeywell

Guidelines for Use and Handling of Solstice® yf

Solstice® yf can be described as being "mildly flammable" as measured by standard methodology. This descriptor is used to characterize the flammability in simplistic terms; however, properties such as minimum ignition energy, heat of combustion, and the burning velocity are assessed in order to arrive at such a descriptor. These measured properties, when applied to the laboratory setting, can be useful in determining if laboratory or apparatus modification should be considered. Measurement of Solstice yf flammability properties indicates that a typical static discharge will not have sufficient energy to ignite Solstice yf. Available data appears below.

Upper Flammability Limit [Vol. % in air] (21°C, ASTM E681-01)	12.3
Lower Flammability Limit [Vol. % in air] (21°C, ASTM E681-01)	6.2
Minimum Ignition Energy [mJ at 20 şC and 1 atm] (In-house method. Tests conducted in 12 liter flask to minimize wall quenching effects)	5000-10000
Autoignition Temperature [°C] (EC Physico/Chemical Test A15, Measured by Chilworth Technology, UK)	405
Heat of Combustion [MJ/kg] per ASHRAE Standard 34 (Stoichiometric composition 7.73% in air)	11.8
Fundamental burning velocity [cm/s] (per ISO 817, Measured by AIST, Japan)	1.5
Minimum Ignition Current (per IEC 79-3, 3rd ed., 1990; measured by UL)	No ignition*
Minimum Ignition Current Ratio (per IEC 79-3, 3rd ed., 1990; measured by UL)	>>1

**Unable to obtain ignition for any current level or test gas mixture when using calibration circuit or spark plug box. After no ignition was obtained using the calibration circuit, attempts were made to obtain ignition using a spark plug.*

Risk assessment and risk minimization in facilities typically requires evaluation on a case-by-case basis since the outfitting of individual facilities may vary from one another in many ways. To assist the end-user in assessing and minimizing risk in association with the use of Solstice yf, a number of general guidelines can be applied.

GENERAL GUIDELINES

Read the Solstice yf Material Safety Data Sheet before beginning work with the material.

Refrigerant with Air

- Fire or explosion may result if vapor-in-air concentrations are within the flammable range and an ignition source of adequate energy level is available.
- Avoid mixing Solstice yf with air, oxygen or other oxidizers at pressures above atmospheric pressure.

Cylinder Storage

- Smoking should not be allowed in storage or handling areas as a general rule. Smoking should be prohibited in storage, handling, and servicing areas where Solstice yf is used.
- Do not store Solstice yf cylinders near sources of open flames, ignition sources or at temperatures exceeding 50°C.
- Store cylinders in a cool, well-ventilated area with low risk of fire and out of direct sunlight. Ensure that cylinders are properly strapped into place; avoid dropping, denting or mechanically abusing containers.
- Protect cylinders from moisture and rusting during storage.

Contact with Hot-surfaces/High Energy/Ignition Sources

- Avoid contacting Solstice yf with white-hot or red-hot surfaces.
- Do not locate apparatus that produce ignition sources in proximity to air-conditioning systems, air-conditioning system test rigs, equipment or storage vessels that contains Solstice yf.
- Air-conditioning systems, test rigs, and service equipment should not incorporate components or devices that can generate discharges.
- Devices that generate sparks may need to be isolated, purged with inert gas (to minimize the probability of attaining concentration in air that are within the flammable range), or relocated.
  - Note that DC motors that use brushes will have potential for continuous spark generation. A fan that uses such a DC motor may have to be isolated, replaced with a non-sparking one, or purged with an inert gas such as nitrogen or with adequate air flow to minimize the quantity of refrigerant within the flammable range. If nitrogen inerting is used, route the exiting nitrogen gas to a local exhaust if practical, otherwise, the adjacent work environment may

also have to be monitored for oxygen level so that an acceptable breathing atmosphere is maintained.

  - As spark energy data may not readily be available, electrical contactors, switches, relays, and other electrical or electronic devices capable of generating a spark that are located in proximity to probable leak sites should be subject to risk evaluation.

- Electrical equipment in and adjacent to the refrigerant charging and storage locations should be electrically classified according to applicable codes and regulations.

  - A typical 0.5 KVA 3-phase transformer with a 6-cycle breaker feeding shop utilization equipment can generate over 450,000 mJ before opening.

- In cases where NFPA 497 *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas 2008 Edition* can be applied, the following guidance is available:

  - *Note that Solstice yf is classified as Group D or Group IIA (per NFPA 497): the autoignition temperature of 405 °C is consistent with use of a T2 temperature class per the National Electric Code (NFPA-70).*

  - Electrical equipment within 5 feet of the charging location and within 3 feet above grade and 25 ft horizontally should be Class I, Division 2, Group D (Class I, Zone 2, Group IIA).

  - In pits or other below grade servicing areas, above which the refrigerant could be charged or within 25 ft of charging locations, mechanical ventilation should be provided with a pickup no more than 12 inches above the lowest level and the electrical equipment within the pit should be Class I, Division 2, Group D (Class I, Zone 2, Group IIA).

  - In unoccupied, non-ventilated pits within 25 ft of charging locations, the electrical equipment within the pit should be Class I, Division 1, Group D (Class I, Zone 1, Group IIA).

- Due to large energy capacity and circuit amperage, there is also a potential for ignition from the electric power source for hybrid vehicles. As a matter of general safety, isolation techniques or other suitable methods should be used to prevent battery and power system sparks/arcs. In areas where processes, procedures or upset conditions such as leaks have the potential to generate flammable Solstice yf vapor-in-air concentrations in proximity to hybrid vehicle electric power sources, isolation and/or ventilation should be used.

Service Areas

- Solstice yf is a heavier-than-air gas. Depending on the quantity released in air, the material can travel a considerable distance to a low-lying ignition point.

- Solstice yf can collect in floor pits. There is potential for asphyxiation in floor pits or confined spaces. Use adequate ventilation in these areas. Monitoring/measuring oxygen levels or refrigerant vapor-in-air concentrations prior to entry into floor pits or confined spaces is recommended. Note that applicable regulations may require measurement and/or monitoring of oxygen level in confined spaces as part of dictated confined space entry procedures.

- Refrigerant charging should be performed away from open flames or high energy ignition sources.

- Provide mechanical ventilation at filling zones and storage areas or other locations where leakage is probable. It should be determined if existing local ventilation is adequate for other operating and storage areas. The ventilation rate should prevent vapor–air concentrations from exceeding 25% of the LFL. For example, NFPA 497 *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas 2008 Edition* defines adequate ventilation as a ventilation rate that affords either 6 air changes per hour, or 1 cfm per sq.ft. of floor area ($0.3m^3$/min per m^2 of floor area), or other similar criteria that prevent the accumulation of significant quantities of vapor–air concentrations from exceeding 25% of the LFL.

- Refrigerant leak detection equipment that provides continuous numerical vapor-in-air measurement provides a means for personnel to respond to a leak in a timely fashion. A detection level of 25% of the lower flammability limit is acceptable. Infrared leak detection devices capable of detecting R134a at levels of 1,000 ppm in air or lower are commonly available; typically, these may also be used. Performance may vary depending on device configuration. Consult the leak detection equipment manufacturer for additional information.

- In the event of a leak, air flow will tend to disperse leaked refrigerant and may be beneficial in reducing local concentrations. Exhaust ventilation can be used to reduce vapor-in-air concentrations. The aim should be to maintain concentrations below the lower flammability limit. For example, in a calorimeter room, it may be best to leave the room air circulating (room air handler "ON") to disperse leaked refrigerant rather than shutting off room air flow. Note: This assumes that the charge is smaller than the amount needed to reach the 25% of the LFL in a well mixed room.

- In the event of a leak, nearby electrical contactors, electric controls, or other electric devices may create an undesirable spark in the affected area if the devices are shut off locally. In accordance with good engineering practices, interrupt power to systems and devices at a location that is removed (remote) from the environment where the leak is. Whenever possible, create a “zero demand” signal to electrical or electronic devices, for example, adjust a servo-controlled relay serving electric resistance heaters to eliminate demand. This is preferred to opening local contacts.
- Maintenance or construction work that can produce sparks, electrical arcs, or open flames must be performed in compliance with all applicable regulations pertaining to hot work. Welding, flame cutting, grinding, or other operations that can create an ignition source, must be carried out in compliance with applicable hot work procedures and permits.

Additional good engineering safety practices:

Customer should perform their own

fire & safety review
building code review
fire alarm systems
smoke detection systems
suppression systems
Fire extinguishers
egress procedures
fire separation systems
emergency response procedures
emergency lighting

Common considerations for Solstice yf product handling & plant implementation

Tank Truck (ISO) Unloading

1. Is the unloading area in good condition for safe operation?
2. During inclement weather, should any additional safety precautions be considered?
3. Is grounding cable available and free of corrosion or damage for delivery trailer?
4. Is the electrical receptacle properly located within 25 ft (7.5 m) by 3 ft (1 m) high radius and properly rated (Group D)?
5. What ype of electrical receptacle is available (i.e. Hubbell, Four Prong, male, female, amperage, etc)?
6. Is the receptacle equipped with an electrical switch disconnect?
7. Is the bulkhead designed for impact (crash posts installed, anchored) and located more than 15 feet from the bulk storage tank?
8. Is the liquid line equipped with an Emergency Shutoff Valve (ESV) or Backflow Check valve?
9. Is the vapor line equipped with an Emergency Shutoff Valve (ESV)?
10. Can the Emergency Shutoff Valves be actuated nearby and remotely?
11. Will Emergency Shutoff Valves be automatically activated by fire (e.g. fusible link shut off valves)?
12. Do fill lines and/or hoses have caps and/or plugs in place?
13. Are all lines identified?

Bulk Storage Tank

Tank needs to be designed, installed and operated according to appropriate regulations and laws!

1. Is tank design pressure adequate?
2. Is the area free of combustibles?
3. Is the area fenced or protected from vandalism?
4. Is the tank adequately grounded?
5. Is the grounding free of corrosion?

6. Is the grounding checked periodically?
7. Are all electrical switches, lighting, etc. rated appropriately?
8. Are pump motors rated appropriately?
9. Are all elastomeric parts (seals, gaskets, etc.) compatible with the product?
10. Are the tank supports fireproofed (cement, etc.)?
11. Is the tank properly labeled?
12. Is a tank label visible?
13. Does instrumentation (level gauge, pressure gauge, etc.) appear to be in good condition?
14. Is the tank exterior free of corrosion?

Piping

1. Is the piping free of any signs of exterior surface corrosion?
2. Are all gasketing and valve internal materials compatible?
3. Is piping and other equipment grounded? (Piping systems with large filter elements can develop significant static charge separation. Generally, piping systems should be grounded unless an engineering evaluation determines that it is not needed.)
4. Is grounding free of corrosion?
5. Is piping adequately supported?
6. Is valving designed to avoid trapping liquid between valves?
7. Is piping protected from impact?
8. Is piping leak checked on a regular basis?
9. Is piping labeled to identify contents?
10. Is piping inside the building constructed with a minimum of valves, fittings, etc.?
11. Is the diameter of the piping inside the building the minimum size required?
12. Are block valves provided at both ends of the pipeline to isolate a leak?

Cylinder Storage Area

1. Is the cylinder(s) stored on a rack or firm foundation, i.e. concrete pad?
2. Is the storage area protected from excessive heat and adverse weather conditions?
3. Is the area fenced or protected from vandalism?
4. Are all electrical switches, lighting, etc. rated appropriately?
5. Is the area properly labeled as to contents?
6. Are the cylinders stored upright?

Personnel Training

1. Do personnel know product hazards and have access to MSDS's?
2. Are personnel trained to handle flammables?
3. Is there a written emergency response plan?
4. Does each person know his/her responsibility in case of an emergency and is properly trained?
5. Does maintenance personnel know what materials of construction are compatible with Solstice yf?

Find out more

For more information...

Honeywell Refrigerants
101 Columbia Road
Morristown, NJ 07962-1053
1-800-631-8138
www.honeywell.com

January 204