HAWKEYE
INTERNATIONAL, LTD.

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DATA SHEETS

HKAS 666-O ANTI-STATIC NYLON FILM

HKAS 666-O is a specially formulated nylon film based on nylon 6 polyamide resin. This film is a tough, versatile film which is ideally suited for physically demanding and high temperature performance applications. HKAS 666-O has exceptionally high burst, impact, tear and tensile strength and has excellent resistance to abrasion, puncture, flex crack and pinholing. Combined with its excellent anti-static properties, barrier to fats, oils, and grease and low permeability to gases, this film is especially suitable for a variety of high temperature industrial processing and packaging applications. HKAS 666-O can be coated, laminated, metallized and printed. It can also be vacuum thermoformed, steam and gas autoclaved, and fabricated into sleeves and bags.

HKAS 666-O can be used for chemical processing and packaging, clean room packaging, medical autoclaving, solvent recovery and recycling, and vacuum bag molding of aerospace composites and architectural glass products. It can also be used for numerous other packaging and industrial applications. HKAS 666-O film is rated for temperatures up to 400ºF (204ºC).

TECHNICAL DATA

PHYSICAL PROPERTIES		
Basic Resin	Nylon 6	
Color:	Orange Tint	
Thickness:	.0015", .002", .003"	
Yield (sq. in per lb):	24,000	
Tensile Strength (lbs per sq in):	16,000	(ASTM 6-882)
Elongation at break (%):	380	(ASTM 6-882)
Yield Strength (psi)	4,500	(ASTM 6-882)
THERMAL PROPERTIES		
Crystalline Melting Point	428ºF (220ºC)	Hot Stage Microscope
Heat Shrinkage (30 min @ 300ºF)	<2	ASTM D-1204
Flammabiltiy	Self-Extinguishing	ASTM D-568
BARRIER PROPERTIES		
Water Vapor Transmission (100ºF @0%R.H.):	19-20	Pouch Method
Oxygen Permeability (cc/100 sq in/24 hrs/atm):	2.6	ASTM D-1434
Nitrogen Permeability (cc/100 sq. in./24 hrs./atm):	0.9	ASTM D 1434
ANTI-STATIC PROPERTIES		
Surface Resistivity (Ohms):	2x10^10 – 5x10^10	ASTM D-257
Decay Rate (Seconds)	<2.0	12 + 3% relative humidity and 73ºF +/- 5ºF

NOTE: Technical information furnished by HAWKEYE is based on laboratory findings and is believed to be correct. No warranties of any kind are made except that materials supplied are HAWKEYE quality. All risk and liability arising from handling, storage and use of HAWKEYE products, as well as compliance with applicable legal restrictions rests with the buyer.

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DATA SHEET

HKAS 1200
POLYETHYLENE ANTI-STATIC FILM

HAWKEYE HKAS1200 ANTI-STATIC Film, Bags, Zip-lock Bags, and Zip-lock Bubble Bags meet MIL B-81705-B, Type 2: Barrier Materials, flexible electro-static free and heat sealable.

Standard anti-static bag sizes range from .006" X 1" X 2" to .006" X 36" X 48".

Standard sizes for anti-static zip-lock bags, in thicknesses of both .004" and .006", range from 4" X 4" to 12" X 12" and can be supplied with anti-static zipper.

Anti-static zip-lock bubble bags have a non-removable label which reads, "Reusable Pouch. Do Not Discard".

Sizes and gauges other than those shown above are available on special orders.

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DATA SHEET

HKAS 1200
POLYETHYLENE ANTI-STATIC FILM

TECHNICAL DATA

Basic Resin:	Virgin, low density polyethylene
Color:	Pink Tint
Sizes Available:	
Sheeting	To 96" - Centerfold over 42" wide
Layflat Tubing:	1" to 48"
Thickness:	.002" - .004" - .006"
Yield (Sq. In. per Lb):	.002" - 15,000
	.004" - 7,500
	.006" - 5,000
Tensile Strength, MD (lbs/sq. in.):	.004" - 2940 psi
	.006" - 2760 psi
Elongation (%):	380 - 410
Dart Impact Strength (gms):	167 - 230
Coefficient of Friction: (ASTM D1894):	.004" - .44 static ave./.35 kinetic ave.
Surface Resistivity (Max Ohms per NFPA 56A	.004" from 1 to 2.5
at 20% RH & 70 degrees F):	.006" from 1 to 1.2
Decay Rate*:	Below 0.25 seconds for all sizes

* Decay Rate is the time it takes to discharge a charged sample from maximum voltage to 10% of the applied voltage. In this case the specimens were charged to 5000 volts and discharged when grounded to 500 volts, in less than .25 seconds at 20% relative humidity and 70 degrees F.

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HKAS 1200
POLYETHYLENE ANTI-STATIC FILM

STANDARD CENTERFOLD SHEETING SIZES

HKAS1200 Sheeting meets the electrostatic requirements of MIL B-81705-B, Type 2.

Thickness	Sheet Width	Roll Width	Roll Length	Approx. Weight Lbs per Roll
.004”	48”	24”	500’	38.4
.004”	54”	27”	500’	43.2
.004”	60”	30”	500’	48.0
.006”	48”	24”	500’	57.6
.006”	54”	27”	500’	64.8
.006”	60”	30”	500’	72.0

STANDARD TUBING SIZES

HKAS1200 Tubing meets MIL B-81705-B, Type 2 requirements.

Thickness	Width	Roll Length	Approx. Weight. Lbs per Roll
.006”	1”	500’	2.4
.006”	2”	500’	4.8
.006”	3”	500’	7.2
.006”	4”	500’	9.6
.006”	6”	500’	14.5
.006”	8”	500’	19.2
.006”	9”	500’	21.6
.006”	10”	500’	24.0
.006”	12”	500’	28.8
.006”	13”	500’	31.2
.006”	14”	500’	33.6
.006”	16”	500’	38.4
.006”	18”	500’	43.2
.006”	20”	500’	48.0
.006”	24”	500’	57.6
.006”	30”	500’	72.0

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DATA SHEET

HKAS 2400 ANTI-STATIC FILM

HAWKEYE HKAS 2400 Nylon Anti-Static Film is a specially designed transparent anti-static heat stabilized fluorescent orange nylon film, containing an internal organic anti-stat throughout the material which renders all surfaces of the film permanently static-conductive over a normal lifetime.

Retaining its static-dissipating properties even when ultra-cleaned, HKAS 2400 can end the problem of particle attraction in clean room packaging of precision parts. Moreover, its heat stability permits dry heat sterilization of spacecraft and components within the sealed bag. HKAS 2400 eliminates the spark discharge hazard around electro-explosive devices and sensitive electronic components. Tests record HKAS 2400 bags can withstand 12 hours of exposure at 300°F (148.88°C) without marked degradation where ordinary nylon browns and embrittles.

SPECIFICATIONS

Forms Available:; Drapes	Roll Stock, Fabricated Bags, Large
Color:	Transparent Fluorescent Orange*
Thickness (inches):	.002”
Maximum Width:	54” unseamed
Specific Gravity:	1.15
Yield (Sq. In/lb)	12,200
Tensile Strength (lbs/sq inch):	13,500 - 15,000
Elongation:	Over 200%
Fold Endurance:	Excellent
Abrasion Resistance:	Excellent
Flammability:	Self-Extinguishing (ASTM D-1433-58)
Water Vapor Transmission Rate: Gm/100 sq. in/24 hr./mil at 100°F, 90% RH Approximate	8.0
Gas Permeability: (cc/100 sq in/24 hr./’mil/atm. at 75°F, 50% RH, Approx.	
Oxygen:	1.0
Carbon Dioxide:	2.0
Shelf Life:	Indefinite in normal indoor storage
Maximum Use Temperature:	400°F (204.4°C)

*The fluorescent orange tint used in HKAS 2400 fads away on long exposure to UV light, as in curtains or drapes, to improve visibility. Other properties are not affected; only the color changes.

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GUIDELINES OF CLEAN ROOM PACKAGING

With the growing emphasis being placed on the control of contamination by the aerospace electronic and pharmaceutical fields, ever more stringent cleanliness requirements are being applied to finely machined parts, purified drugs and many other items whose satisfactory function depends on the virtual absence of foreign or particulate matter.

Once such items have been cleaned to their fantastically low particle counts, it becomes necessary to package them in such a manner as to maintain this degree of cleanliness during storage, shipping, handling, testing and so on until final assembly or use.

Experience and practice over the past few years have indicated that the best way to package such items, for reasons of weight and cube (the space taken up by a packaged item), is in flexible, heat sealable transparent plastic film which has been cleaned to the same stringent levels as the item to be packaged. Because the plastics used must possess very particular properties depending on their end use, many packaging films must be eliminated from consideration for various reasons. In all, only three films have stood the test of clean room usage and have become the films in general use. They are polyethylene, nylon and Aclar films. the following is a quick guide to their nature and uses.

POLYETHYLENE: The generally accepted abbreviation for polyethylene is “Poly”. While poly is the first name of every plastic, the trade has applied it to the most common of packaging films. Poly is a pure hydrocarbon, available in a wide range of densities with generally low and broad melting ranges. It has a good inertness to most chemicals, with such notable exceptions as LOX and hydrocarbon solvents, and is inexpensive and relatively easy to clean and to seal. However, poly is soft and readily sloughs particles of its surface when abraded or flexed, so that its use should be confined to relatively non-critical areas in clean packaging. These include overwraps for inner bags of nylon, for example, where the poly serves to provide a better moisture barrier than that supplied by the slough-resistant inner nylon bag. Poly bags are generally 6 mils thick for clean use. Plain poly, however, has been displaced to some extent by a pink polyethylene anti-static (HKAS1200) material, which prevents the static charges which attract dust to normal poly.

NYLON: This film is the lowest-sloughing film available, generating fewer particles when exposed to abrasion and flexure than any known transparent film. Nylon 6 (the 6 is a generic reference to the number of carbons in its molecular chain units, as opposed to nylon 11 or nylon 6.6) is the established polyamide film in clean room use for packaging ultra-precise parts where particulate contamination must be held to the absolute minimum. The only field where nylon should be avoided as an intimate barrier, is the packaging of LOX service parts, and those destined for use with similar violent oxidizers, where the few particles sloughed from the surface of a nylon film or any other film, except a fluorocarbon, can constitute a potential explosion hazard when the part is placed in service in a LOS system. The other major fault of nylon is that it readily allows moisture vapor to pass through it, so that a second or outer bag made of poly, Aclar or a laminate should be used over the inner nylon bag, to provide the missing moisture vapor barrier, while the nylon prevents sloughing. In clean applications nylon film,. 2 mils thick, is the most frequently chosen. Again an anti-static nylon, orange tinted (HKAS2400) is displacing normal nylon from clean rooms.
ACLAR: Allied Chemical's trademark, for their fluoroholocarbon film is Aclar. Clear and transparent, inert to almost all chemicals and certified by NASA as LOS-compatible under their impact test (MSFC-SPEC-106A) with liquid oxygen. Aclar is also the finest moisture vapor barrier available among transparent films. Aclar is the most costly of packaging films, but is among the least expensive of fluorine-bearing films, and is the least expensive LOX compatible film known. It is essentially a chlorotribluorethylene copolymer with small percentages of other fluorocarbons, unplasticized, specially tailored to give the fantastic barrier properties described above. Three grades (Aclar 22C, Aclar 22A and Aclar 33C) are available. All are LOX-compatible, but the Aclar 33C is in most general use. Bags are usually made of 2 mil Aclar; roll stock may be 2 or 5 mil, as needed. Aclar cannot be tinted or rendered anti-static without affecting its properties adversely.

All of the films mentioned above are widely available from manufacturers, they are offered only in a commercially clean grade. This is far too dirty in terms of today's technology too be suitable for clean room use. These films must be cleaned to the rigidly low particle counts required. HAWKEYE certifies t these levels to the user, offering clean roll stock, tubing or fabricated bags of a wide range of sizes, all to meet clean room requirements. Non-volatile residue (NVR) level is certified also, where applicable.

For optimum protection of packaged parts, bags should be hermetically sealed, using heat. While poly may be sealed by constant heat or "hot bar" methods, Aclar and nylon, with their high and relatively sharp melting points do not lend themselves readily to this type of seal. Therefore, general practice dictates the use of thermal impulse sealers, capable of making adequate seals in ALL THREE clean room films.

In both Aclar and nylon, such seals often exhibit a characteristic tendency to tear or to “zipper” along a line adjacent to the seal when severely strained. This is due to a line of increased crystallinity formed by the slow cooling or quench of the molten plastic in the insulated jaws of the sealer. It may be minimized and controlled by careful calibration of the sealer and keeping the cooling time as short as practicable; however, the phenomenon should be understood as the reason why seals in these films are not as strong as the film itself. In nylon, seals dehydrated of their plasticizing moisture by melting, may be restored to maximum flexibility by moistening or exposing to humid air for a few minutes.