ASTRALON (in Englisch), 1966
Firmenschrift von 1966

Contents

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1. General

ASTRALON is a thermoplastic Vinyl copolymer. Its properties make it especially suitable for the manufacture of articles in general and technical use which require high performance in respect of dimensional stability to weather and to chemicals.

ASTRALON burns only with difficulty and has high light stability, dependent on the intensity of the radiation.

Its fields of application include the following:

Scales, measures, drawing instruments, slide rules

Accurate drawing and copying sheets for cartographic work*

Picture carriers in the graphical trades*

Clichés and matrices*

Printed instructions, tables, calendars and the like

Engraved and stamped name and advertising plates

Advertising letters (also transparent) for indoor advertising

Small stationary items, office machine parts

Covers for maps and season tickets

Encasing printed papers and cards to prevent forgery

Refrigerator parts such as interior containers, door liners, drip trays etc.

Small packages and tops of containers for the food and pharmaceutical industries

Components for apparatus, coloured and transparent, for the chemical and artificial silk industries

Covers for machines and apparatus

Lampshades

2. Forms available

ASTRALON is supplied in various qualities.

Cartographic ASTRALON is a special grade and is dealt with in a separate booklet.

ASTRALON N is colourless, transparent and is made in all transparent, translucent and solid colours. It is suitable for forming under heat since it softens at 60° C. ASTRALON N is the normal quality which is supplied when there are no special requirements.

ASTRALON T is likewise colourless and crystal-clear. It is made in all transparent, translucent and solid colours, and is specially designed for vacuum forming and for deep drawing under heat.

* Special brochures on request

ASTRALON U is light coloured and transparent and is made in solid colours, including white and black; its stability to some strongly reactive chemicals and to solvents is higher than that of ASTRALON N. Since it softens only at 70° C, it has better heat stability, and necessitates the use of higher working temperatures.

ASTRALON is also supplied as a laminate which by bonding together various layers, can be made in different colours and thicknesses. The laminated material is used in particular for engraved signs.

ASTRALON N, T and U is produced in sheets.

Thinnest sheets, 10 thou, with tolerance of ± 10%. Sheet sizes approx. 24 x 55", 32 x 64", and 40 x 80".

Surface finishes: polished, matt, satin matt, emb[illegible]ed, calendered. Each side of the sheets can also be provided with any of the above four surfaces. „Calendered finish" is only available in thicknesses of approx. 10 — 32 thou with a tolerance of ± 15%. Apart from the three sheet sizes, calendered ASTRALON can be supplied also in rolls of 24 — 40" wide and in any required lengths up to 50 yards. The other surface treatments are not available in roll form.

Minimum orders: Transparent clear, white, black and the standard colours of the range are normally not subject to a minimum quantity. If, however, special shades are requested, a minimum order of each kind of 220 — 660 lbs. is required.

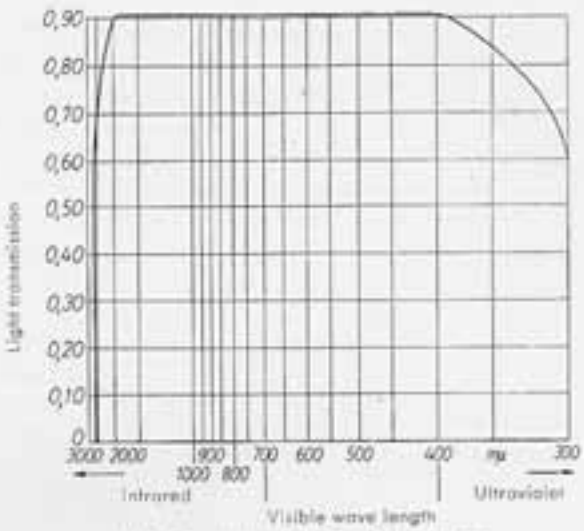
3. Properties of ASTRALON (Values at 20° C)

			ASTRALON N	ASTRALON T	ASTRALON U
Specific Gravity:	DIN 53 479	(transp.)*	1.35	1.36	1.38
Mechanical Properties					
Tensile strength	DIN 53 455 psi		8500	8500	8500
Bending strength	DIN 53 452 psi		17000	17000	17000
Compressive strength	DIN 53 454 psi		10700	11400	11400
Impact strength	DIN 53 453 ft.lb./in			no break	
Notch test	DIN 53 453 ft.lb./in		0.56	0.56	0.56
Softness test	VDE 0302 psi		15600	13500	17000
Modulus of elasticity	psi		420000	420000	420000
Elongation	DIN 53 455	%	> 15	50	
Thermal Properties					
Softening Range		°C	50—60	50—55	60—70
Martens hardness	DIN 53 458	°C	66	58	70
Vicat hardness	DIN 57 302	°C	78	70	82
Heat conductivity technical units		kcal/mh °C	0.14	0.14	0.14
physical units		cal/cm sec °C	39×10^{-4}	39×10^{-4}	39×10^{-4}
Heat expansion			78×10^{-6}	75×10^{-6}	70×10^{-6}
Specific heat		cal/gm °C	0.29	0.29	0.29
Combustibility			Extinguished when flame is removed		

* The density for pigmented ASTRALON amounts to 1.40—1.47

			ASTRALON N	ASTRALON T	ASTRALON U
Electrical properties acc. to DIN 53 482					
Specific resistance		Ω cm	$> 10^{14}$	$> 10^{14}$	$> 10^{14}$
Insulation resistance between plates VDE 0303, direct		Ω	$> 10^{13}$	$> 10^{13}$	$> 10^{13}$
Insulation resistance between plates					
after 4 days at 80 % relative humidity		Ω	$> 10^{13}$	$> 10^{13}$	$> 10^{13}$
Surface resistance, direct, VDE 0303		Ω	$> 10^{13}$	$> 10^{13}$	$> 10^{13}$
Surface resistance after 24 hrs soaking in water		Ω	$> 10^{12}$	$> 10^{13}$	$> 10^{13}$
Surface resistance, comparative figure			12	12	12
Dielectric Constant					
50 c/s	DIN 53 483		3.5	3.5	4.0
800 c/s			3.4	3.4	3.9
1 Mill. c/s			3.2	3.2	3.4
Dielectric Loss factor tan δ					
800 c/s	DIN 53 483		0.015	0.024	0.020
1 Mill. c/s			0.016	0.020	0.015
Dielectric Strength	DIN 53 481	Kv/mm	> 20	> 20	> 20
Optical properties (transparent material)					
Refractive index	DIN 53 491		1.53		

Light transmission 0.25 mm thick — see following curve



Light Transmission of 0.25 mm thick Astralon (corrugated, transparent)

Stability

Water: All three ASTRALON qualities absorb very little water (after seven days soaking in water ASTRALON N absorbs 25 mg per 100 sq.cm; ASTRALON T, 30 mg / 100 sq.cm; ASTRALON U, 15 mg / 100 sq.cm and transparent qualities under 10 mg / 100 sq.cm). ASTRALON, therefore, does not swell in water or in moist air. Shrivelling, blooming and damage to the surface polish can, however, occur in hot water or steam.

Inorganic chemicals: At room temperature ASTRALON is stable for long periods against almost all diluted and concentrated metal salt solutions, alkalis and acids. Exceptions are conc. nitric acid, for ASTRALON N and T also conc. sulphuric acid. ASTRALON U generally is stable up to + 60° C, ASTRALON T and N are stable up to 40° C. ASTRALON is not attacked by most corrosive gases (including dry chlorine) but the transparent material may become cloudy. ASTRALON is not stable to Ammonia, Halogens and Sulphur Dioxyde in liquid form.

Organic chemicals: ASTRALON U is stable against most organic acids, but ASTRALON T and N are affected by concentrated formic-acids and acetic-acid. Ketones, esters, ethers, chlorohydrocarbons, benzol hydrocarbons, aromatic amines and phenols will cause ASTRALON to swell and become unusable.

Carbontetrachloride will also cause swelling but to a lesser degree.

However, ASTRALON is resistant to lower alcohols, aliphatic hydrocarbons (petrol and petroleum) as well as to vegetable and animal oils and fats. Stability tables will be sent on request.

As solvents, methyl-chloride, cyclo hexanone or tetra-hydrofuran may be used, and for ASTRALON U which can be dissolved only with difficulty the last named being of particular value.

4. Working ASTRALON

a) Surface treatment, inscribing

General: ASTRALON is not hard. To protect the surfaces, the sheets are therefore packed in tissue paper, which clings to them by virtue of electrostatic charge. The paper should be retained as long as possible during working. The sheets should not be moved or stacked without protection.

Cleaning materials must contain no hard substances and sponges and dusters must be soft and clean. Slight scratches may be polished away (for polishing materials see below) but larger faults are difficult to remove.

Storage: ASTRALON sheets, particularly the cartographic material, should always be stored flat and at room temperature. The material should not be rolled.

Grinding and Polishing: For grinding, a grinding disk should be used, built up of alternating two layers of larger and smaller disks of twill. As grinding material, fine pumice, Tripoli or Vienna chalk are made into a paste with water. For polishing, a grinding disk should be used which at 300 mm ⌀ makes about 1400 revs per minute, using a polishing paste such as Cl[illegible]nit supplied by Messrs Blasberg of Solingen or with a polishing paste from Langbein-Pfanhauser-Werke. The work is polished dry afterwards with a second disk. Owing to the softening action of heat on the material, it should be only lightly pressed against the disk.

For **inscription,** the following firms supply suitable ink: Hanns Eggen, Hannover; Hausleiter & Co., München 19, Günther Wagner, Hannover.

Inscriptions can be made with a steel pen, drawing pen or brush. Special inks and colours are obtainable for glazed writing.

Inscriptions by embossing can be carried out using the usual stamps, but either the material, or better the stamp should be warmed up. For temperatures see below.

For **printing,** special printing colours are used and are supplied amongst others by the following firms: Hostmann & Steinberg, Celle near Hannover; Kast & Ehinger, Stuttgart-Feuerbach; Ramp & Co., Eppstein/ Taunus. It is advantageous to accelerate the drying by the addition of 1 to 5% of driers.

b) Working with cutting tools

ASTRALON is intermediate in behaviour to cutting tools between Celluloid and Trovidur, so that experience with these materials can be used as a good guide.

In general please note:

ASTRALON is a poor conductor of heat; in order to avoid overheating of tools and softening of the ASTRALON it is best to cool with compressed air. Tools designed for work with light metals are suitable for ASTRALON. Sharp cutters are essential and high speed steel is recommended. Hard metal cutters are not necessary. Since high cutting speeds and low feeds are expedient, high speed machines should be used.

Cutting: Sheets up to 3 mm (1/8") thick are cut with hand shears or guillotines. It is important to cut vigorously with the blades pressed well together, so that the material does not splinter. Thin sheets in stacks up to 3" high can be cut with a face cutter as used in the Paper industry. The material should not be cut too cold. It should be at least at room temperature, but it is advantageous to warm ASTRALON N and T to 30° and ASTRALON U to 40° C.

Punching and boring can be carried out by the tools used for metalwork. The diameter of the holes, their distance from the walls and from each other should not be less than the thickness of the sheet. The cutter should not be pressed in too quickly. Pre-warming is recommended.

Sawing: Sheets over 1/8" thick must be sawn. This can be done by hand with a fine toothed padsaw or with a hacksaw and also mechanically, using woodworking tools, circular-, band-, scroll- and vibratory-saws. For bandsaws, the teeth should 3 mm apart,

for circular saws slightly less. The form of teeth used on the usual circular saw blade for woodworking (ground in notches, giving a cutting angle of about 10°) is not suitable for the sawing of ASTRALON. The teeth must be ground so that the cutting angle is 0°. It is important in sawing that the ASTRALON is well supported and that the feed is not too rapid. Overheating must be avoided under all circumstances or the material will smear.

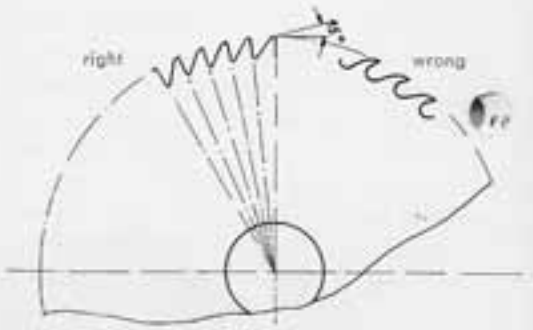


Illustration No. 1
Circular saw Blade

In **turning** and **boring,** it is necessary to make sure that the swarf can escape readily. For turning, the cutting angle should be 0 to 6° (minus), the clearance angle 15° so that a lip-angle of 69 — 75° results. The cutting angle for drills must always be 0°. To obtain a smooth surface, cutting tools should be lapped.
When fastening ASTRALON panels with screws, care should be taken that the screws are not too tight. An elastic interlayer between the screwhead and the panel is recommended.
Milling is a very suitable method of working for higher cutting speeds and greater depth of cut. High speed surface milling equipment of the wood working industry can also be used. As with turning, sawing and drilling, the cutting angle of the milling tool should be 0°. The cutting velocity of high speed steel tools should be 30 — 40 yards/min. at a feed rate of 0.1 to 2.0 mm. Mill cutters should be well stoned so that the material cannot clog them. Special milling machines which are recommended are supplied among

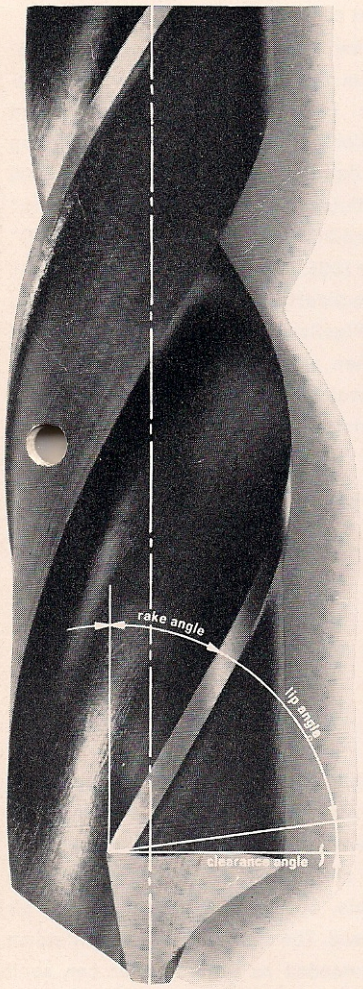
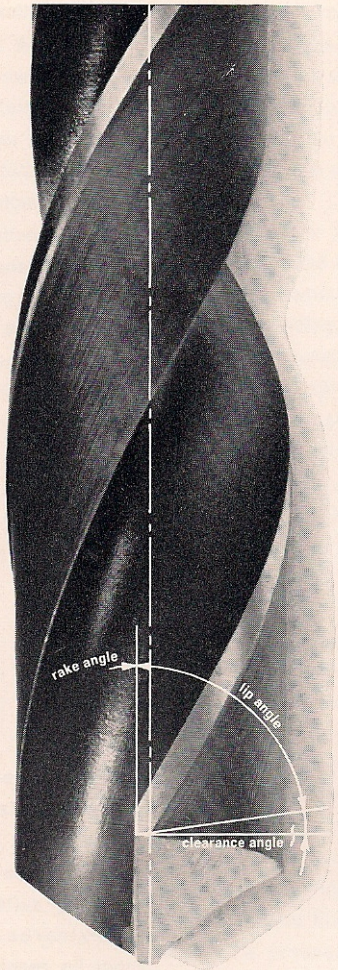


Illustration No. 2
Cutting angle: left drill shows normal metal drill, right drill is re-ground for Astralon



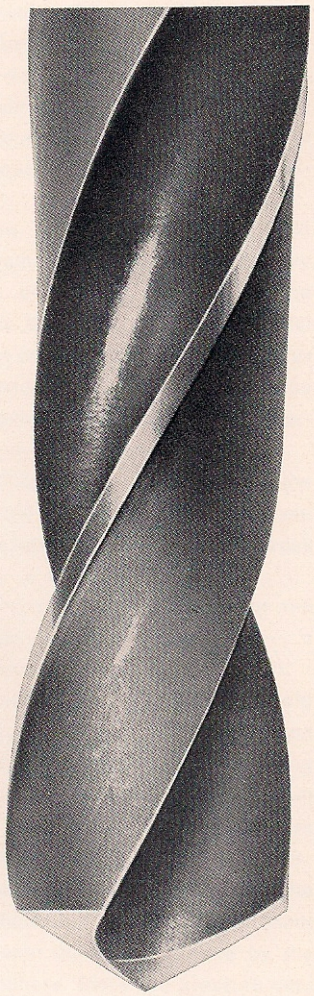


Illustration No. 3
Astralon drill showing grinding of inner cutting edges.

others by the firm Hahn & Kolb of Stuttgart and Hahn & Kolb of 83/85 Graf-Adolf-Straße, Düsseldorf.
Engraving can be done with a small hand engraver with a movable spindle. The engraver must be well cut back (35 to 40°) so that during engraving the material behind the tool cannot clog. A recommended Universal writing and engraving machine (Reference G 1 U) is supplied by the firm Deckel of 7-13 Waakirchner-straße, Munich. The same firm makes a special polishing machine (SON) for the engraver.

c) Forming without cutting*

Preliminary: A new trade, that of "Plastics craftsman" has grown up around the working up of thermoplastic materials, in particular heat forming and welding. The underlying principles of the working method are laid down in the VDI-Manual VDI 2008 "Forming of semifinished goods from Vinyl Polymers" and in the Standard DIN 16 930 "Welding of hard PVC" published October 1955. The following short directions cannot replace practical training; appropriate courses are held at the Plastics Institutes of the Technical Colleges of Aachen and Darmstadt, but in case of necessity our Development workshops are available to give further information.

Working Temperatures

	For forming according to method	The work is cooled under tension to
ASTRALON N	60— 70° C**	40° C
ASTRALON T	90—130° C**	40° C
ASTRALON U	90—130° C**	60° C

Warming and cooling the materials: It is necessary to heat the material uniformly throughout, avoiding local overheating, to prevent setting up internal stresses. Ovens with heat circulation and infra-red rays are particulary suitable, but heating plates and hot air streams may be used. The use of water baths or steam cannot be recommended as water vapour can spoil the surface. Long periods of heating, such as leaving sheets all day in the oven or stronger overheating must be avoided, not only on account of the surface but also because decomposition can occur under these conditions. The material must be cooled below the temperatures listed above, when the forming process is complete. As far as possible the material should be formed on moulds which are warmed to a temperature near the setting point of the material. If the article is not cooled to the setting temperature in the mould, it will shrink back.

* Special prospectus available

** The polish can be damaged by prolonged heating at the highest temperature

Bending The bending radius should be at least double the sheet thickness. The zone which must be warmed amounts to about six times the sheet thickness. The arrangements for bending and folding correspond to those used in sheet metal working. Cylindrical bodies can be made on a wooden former by means of a rolling cloth.

If ASTRALON is bent cold, there is danger that after a time in the strained state, stress crazing may appear. The amount of crazing depends on the amount of bending, on the strength of the material and on the temperature conditions. A somewhat better result can be obtained with cold bending, if the bending axis runs across the width of the sheet. Nevertheless, cold bending is better avoided altogether.

If the bending of ASTRALON is carried out in the heated state according to the instructions given above, the tendency towards the formation of stress crazing disappears or is much reduced.

Vacuum forming: There are various machines on the market for the vacuum forming of ASTRALON — a list of suppliers will be given by us on application.

Generally dark infra-red is used for heating. The cold ASTRALON sheet up to a thickness of 1/16 in. is placed over the forming tool and brought to the operating temperature by means of the heaters. Sheets from 1/12 in. upwards must be pre-heated. The forming can then be carried out by various processes all characterised by rapid evacuation of the space between the ASTRALON and the mould, so that the plastic sheet material is pressed onto the mould surface by the pressure of the atmosphere. Since the pressure cannot be greater than atmospheric, the degree of shaping is limited. Metal moulds are usually employed (Aluminium Alloys) but in many cases hard wood, LIGNOFOL, casting resin, plaster or modelling stone (STONEX) may be used.

A process allied to the vacuum forming process is the blowing process. In blowing, air at a higher pressure can be used (usually 4 to 8 atm). Since by sucking or by blowing under some circumstances an undesirable distribution of wall strength may occur when the change of shape is considerable, combined processes have also been developed. A detailed prospectus which deals with this method can be obtained on application.

Deep drawing: For the preparation of packages and the like, the deep drawing methods of the tin plate industry are used, in which the draw fold is held 20 to 25 % smaller than the sheet thickness. The pre-heating temperature of the material must be kept low during drawing owing to the frictional heat at the fold, and should generally be held somewhat below the softening point.

Press forming is carried out in two part moulds, which can be prepared easily and cheaply from laminated densified wood LIGNOFOL. For large changes of shape a support is necessary. One half of the mould may consist of a soft press cushion.

d) Welding

The preliminary remarks in the section on "Forming without cutting" should be observed in this connection also. Basically the welding process corresponds very largely in method and form of seam with metal welding processes. In most cases ASTRALON is welded with welding rod but open flame is not used for heating, which is instead carried out with the T.P. welding apparatus which works with a stream of warm air at 200 to 300° C. Welding rod is supplied in natural colour for single welds; with transparent and coloured material, strips cut from the sheets may be used. The quality of the weld depends on a number of factors: Preparation of the seam, distance apart, warming of the basic material or welding aid, the introduction of the welding rod, hand pressure on the welding rod, the handling of the welding jaws and the ability of the welder. It is therefore absolutely necessary to give the welder basic training. For structures which are to carry their own weight, a welding factor of 0.8 is used. We will gladly supply information to those interested in the possibility of high frequency welding ASTRALON. ASTRALON N, T and U can be welded to each other without difficulty. ASTRALON may also be welded to Trovidur (hard PVC) and to soft Mipolam. Since plastic flow commences with ASTRALON N and T at about 140° C and with ASTRALON U at about 160° C the welding temperature must be somewhat lower for ASTRALON N and T. The exact conditions can be determined by practical handwork.

Bonding ASTRALON

The bonding technique for ASTRALON must be adapted to the smooth, dense surface and to the proposed application. Therefore special adhesives must be used, which today are supplied in great variety by the Adhesives industry. The appended list contains a number of such adhesives together with the names of the firms and the types of adhesive, which are designated with the type numbers L, H and M.

These mean:

Type L — Solvent adhesives which contain synthetic resins and/or natural and synthetic rubber.

Type H — Solvent adhesives with natural or synthetic rubber binders which can be reinforced by the addition of hardeners.

Type M — Latex adhesives which contain synthetic resins in aqueous dispersion.

The list obviously cannot be complete and is only in the form of a suggestion. On the one hand, it is impossible to list all the adhesives on the market with all possible bonding combinations and on the other hand, adhesive problems in practice very often present special features. Hence we have only listed under the various bonding processes those adhesives which we have found satisfactory by test and in practical trials. In some cases it is advisable to seek advice from us or the adhesives manufacturers; the methods of bonding are described fully in the literature of the manufacturers.

General instructions

For all bonding processes, the surfaces must be clean and even. ASTRALON must be cleaned before bonding by washing the surface with methylene chloride. The surface to be bonded should be roughened as much as possible, e.g. with sandpaper or by sand blasting. The bonding technique must take account of the impermeability of the surfaces.

In applying solvent- and latex adhesives both surfaces should be thinly coated, then they are left until the adhesive has flowed into the surface and the liquid is partly vaporised, so that the adhesive layers are no longer liquid but tacky and thread forming. In this condition, the surfaces are put together. The joint should be kept under light pressure for at least 12 hours; the solvent residues are then so far vaporized

that failure of the joint is no longer likely. Since the solvent can only escape through the joint, complete drying takes generally about 48 hours. Until this occurs, adhesion cannot be fully established.

In applying solvent adhesives with natural or synthetic rubber bases, with or without the addition of hardeners, both surfaces are likewise coated but are left until the adhesive no longer feels tacky and are then pressed together. Here however, the directions issued by the manufacturers should be followed. The choice of adhesive depends in many cases on the thickness, and the size of the surface of the ASTRALON. For bonding thin sheets, dispersion adhesives are recommended, since with solvent adhesives the action of the solvent can cause slight wrinkling and warping. Dispersion adhesives are also recommended for the bonding of large surfaces and parts that have been prepared by vacuum forming or by other heat forming processes. For bonding transparent materials, in general only solvent or latex adhesives can be used, since rubber adhesives with hardeners are usually opaque and of dark colour.

Bonding of ASTRALON with synthetic resins

The bonding of ASTRALON to ASTRALON is only to be recommended where for some particular reason, welding cannot be used. For bonding ASTRALON N in thin sheets, it is sufficient to moisten both surfaces with methylene chloride or cyclohexanon or a mixture of solvents. To stick thicker pieces, 5 to 10% of transparent ASTRALON scrap and 0.2% of concentrated formic acid should be added to the methylene chloride to improve the bond. Solvent and latex adhesives are suitable for all ASTRALON qualities provided that the above directions are followed.

Specially suitable adhesives are numbers 17, 18, 23 24.

For bonding ASTRALON to other plastics, the following adhesives can be used.

Cellulose Acetate sheet (Cellon)

9, 10, 11, 12, 13, 15, 16, 17, 18, 36

Cellulose acetate — injection mouldings

3, 4, 10, 11, 12, 13, 15, 16, 36

Celluloid

1, 9, 10, 12, 13, 14, 15, 16, 17, 18

Mipolam
4, 9, 12, 13, 14, 15, 17, 18
Melamine and Urea resin mouldings and laminates (Pollopas, Ultrapas) 4, 16, 36
Phenolic resin mouldings (Trolitan) 2, 4, 15, 30
Phenolic resin bonded paper (Trolitax) 15, 16, 36
Plexiglas (Acrylic resin) 23, 26, 27, 28
Polyamides 16, 30
Polystyrene (Trolitul) 2, 6, 8, 10, 16, 30, 36
Trovidur 1, 12, 13, 14, 16, 23, 24, 26
Vulcanized fibre 2, 4, 7, 10, 15, 36

Bonding of ASTRALON to porous materials like paper, cloth, wood

The most stable bond with paper or cloth can be attained by fusing together under heat and pressure. We have carried out numerous operations by this method.

However, the bonding of ASTRALON to these materials with adhesives present no difficulties, since the adhesives are anchored in the pores of the paper or fabric and the solvent can vaporise easily. The best adhesives for this purpose are 17, 19, 23, 24.
KL 2202 and KL 2203 (adhesive list 21, 22) are also suitable.

To stick ASTRALON to wood, it is necessary that the wood should be well seasoned, dry and free from resin. The best bond between ASTRALON and wood is obtained with latex adhesives. It is advisable to pre-treat the wood with a thin coating of adhesive prior to the actual bonding process. The adhesive on the two surfaces is first allowed to dry for a short time and then the two surfaces are pressed together. It is useful to maintain the joint under pressure for several hours, until the water has evaporated. By heating the adhesive layer with infra-red radiation or treating in a heated press, the bond is strengthened. For laminating ASTRALON to plywood in the furniture press, the plates should be heated to about 40° C to accelerate drying.
For smaller surfaces solvent adhesives like PC solution can be used.
Recommended adhesives for ASTRALON to wood are
Latices 19, 20, 37
solvent adhesives 23, 24, 25.

Bonding of ASTRALON to Metals, stonework etc.

Bonding of ASRALON to metals and other dense materials such as concrete, glass, stone is conditioned by the fact that solvents can escape neither through the ASTRALON, nor through the dense material. In the case of most of the adhesives, both surfaces must be roughend up, the adhesive rubbed in and subject to the adhesive manufacturer's directions, left open until the solvent has largely evaporated so that the adhesive is only just tacky. Then the surfaces are brought together under pressure.

Recommended adhesives are:

Metal 4, 6, 9, 10, 12, 13, 15, 16, 36 (best adhesive)

Glass 5, 7, 19

Stone and plaster 19, 20, 23, 24, 25, 26

List of adhesives

Type M = dispersion, latex

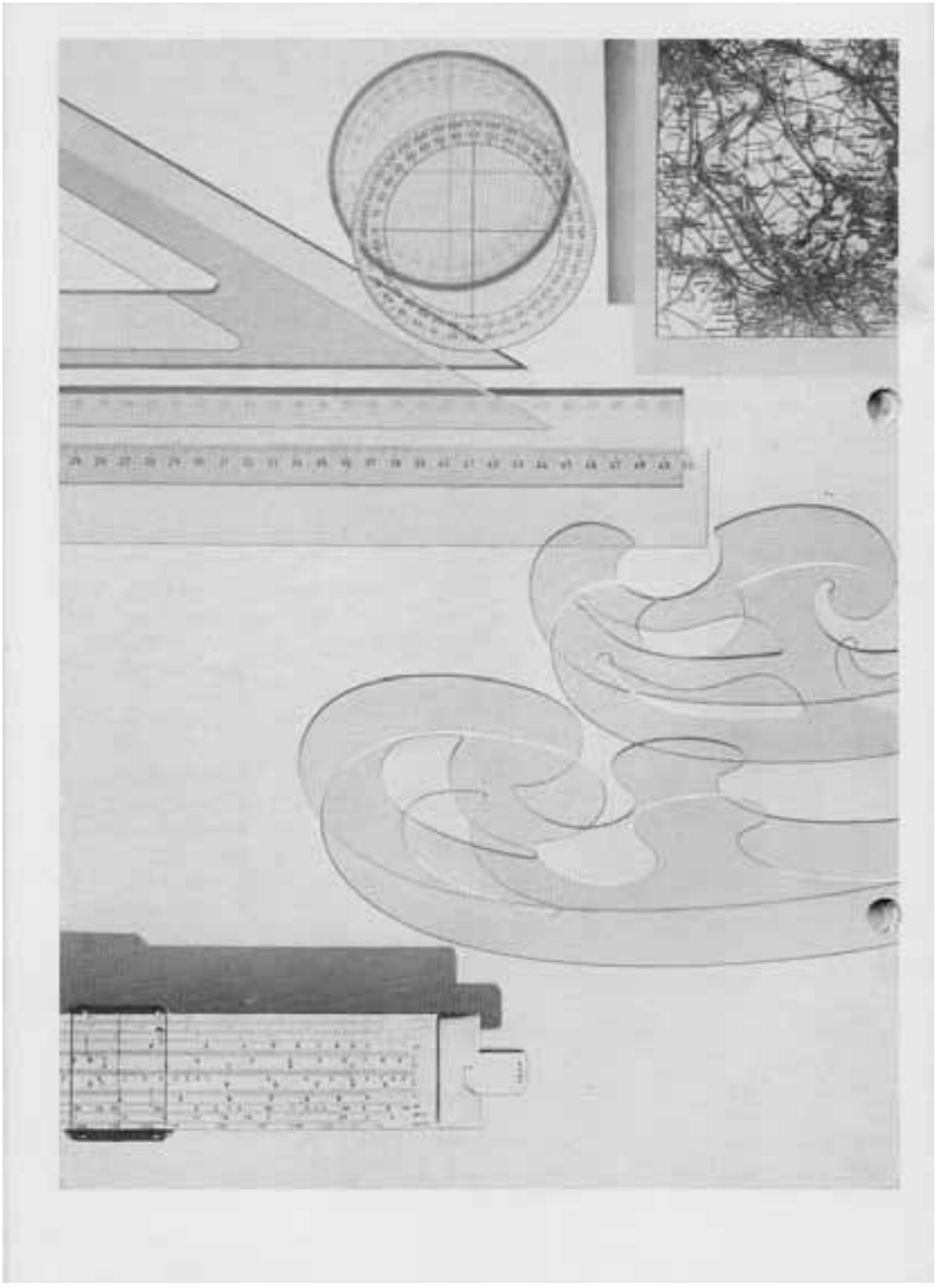
Type L = solvent adhesive based on synthetic resin or rubber

Type H = solvent adhesive based on natural or synthetic rubber which can or must be used with hardeners (vulcanising agents)

No.	Name	Type	Manufacturer*)
1	Boscolin 81	L	Boston-Blacking Comp.
2	Bostik A 4	H	Boston-Blacking Comp.
3	Bostik A 5	L	Boston-Blacking Comp.
4	Bostik 475	H	Boston-Blacking Comp.
5	Bostonia 464	H	Boston-Blacking Comp.
6	Emovin Spezial	L	Keime-Leime, Köln
7	Emovin V	L	Keime-Leime, Köln
8	W Z 1	L	Keime-Leime, Köln
9	Helmiplast	H	Paul Heinicke, Helmitin-Werke
10	Helmitin-Kl. 53 G	H	Paul Heinicke, Helmitin-Werke
11	Helmipren Spezial	H	Paul Heinicke, Helmitin-Werke
12	I-Kleber AT	L	Isar-Chemie G.m.b.H., München 9
13	I-Kleber LT	L	Isar-Chemie G.m.b.H., München 9
14	I-Kleber T 2	L	Isar-Chemie G.m.b.H., München 9

No.	Name	Type	Manufacturer*)
15	Irubban PI 13	H	Isar-Chemie G.m.b.H., München 9
16	Ultraplast M	H	Isar-Chemie G.m.b.H., München 9
17	KL 2101	L	Dynamit Nobel
18	KL 2101 A	L	Dynamit Nobel
19	KL 2137	M	Dynamit Nobel
20	KL 2138	M	Dynamit Nobel
21	KL 2202	M	Dynamit Nobel
22	KL 2203	M	Dynamit Nobel
23	PC 10	L	Dynamit Nobel
24	PC 20	L	Dynamit Nobel
25	PC 13 AM	L	Dynamit Nobel
26	PCE 20	L	Dynamit Nobel
27	PCE 10	L	Dynamit Nobel
28	Methylenchlorid	L	Dynamit Nobel
29	Cyclohexanon	L	Dynamit Nobel
30	Terokal 2192	H	Teroson-Werke, Heidelberg
31	Terokal Boxkleber	L	Teroson-Werke, Heidelberg
32	Plastikkleber	L	Teroson-Werke, Heidelberg
33	Folienkleber	L	Teroson-Werke, Heidelberg
34	Tivocoll 4024	M	Tivoli-Werke, Hamburg-Eidelstedt
35	Tivolit 7048	L	Tivoli-Werke, Hamburg-Eidelstedt
36	Pattex	H	Henkel & Cie.,
37	Schaecollfix-Spez.	M	Schaefer & Co., Wuppertal-Barmen

*) Boston-Blocking Comp., Oberursel/Taunus,
Keime-Leime, Köln-Ehrenfeld, Postfach 20,
Paul Heinicke, Heimilin-Werke, Pirmasens,
Isar-Chemie, München 9, Ständlerstraße 41,
Dynamit Nobel Aktiengesellschaft, Troisdorf/Köln,
Teroson-Werke, Heidelberg, Hans-Bunte-Straße
Tivoli-Werke, Hamburg-Eidelstedt,
Henkel & Cie., Düsseldorf,
Schaefer & Co., Wuppertal-Barmen, Hadersiebener Str. 11.



Bearbaeitet: Dr. Volker Hofmann, Troisdorf, 13. Januar 2012