

KEY MARKETS



Epoxy systems for composites applications



energising possibilities
stimulating growth

INDIA

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Lalbhai Group

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January 2023



bird's eye view of the first site of Atul

Legacy

Founded on September 05, 1947, by a legendary Indian, Mr Kasturbhai Lalbhai, Atul Ltd (Atul) is the first private sector company of the country to be inaugurated by the first Prime Minister, Pandit Jawaharlal Nehru.

About us

Atul is one of the largest integrated chemical companies in India with annual revenue of about ₹ 5,000 cr. The Company manufactures about 900 products (such as *para* Cresol and derivatives, resorcinol and derivatives, vat dyes, sulphur dyes, herbicides, fungicides, tissue cultured date palms, active pharma ingredients and intermediates, epoxy resins, reactive diluents, etc) and 400 formulations and owns 140 brands. It serves a wide range of customers belonging to over 30 industries in around 75 countries and has established subsidiary companies in Brazil, China, Ireland, the UAE, the UK and the USA. The Company offers a wide range of products and applications used in Agriculture, Adhesives, Animal Feed, Automobile, Composites, Construction, Cosmetic, Defence, Dyestuff, Electrical and Electronics, Footwear, Food, Fragrance and Flavour, Glass, Home Care, Horticulture, Hospitality, Paint and Coatings, Paper, Personal Care, Pharmaceutical, Rubber, Soap and Detergent, Sport and Leisure, Textile, Tyre and Wind Energy industries.

The production facilities of Atul and its associate, joint venture and subsidiary entities are at Ambernath, Ankleshwar, Jodhpur, Panoli, Tarapur and Valsad in India and Somerset in the UK. The first manufacturing site of the Company in Atul, Gujarat is spread over 1,250 acres. The Company has its registered office in Ahmedabad and its head office at Atul, both in Gujarat, India. Its shares are listed both at NSE and BSE.

Polymers - Performance Materials Business

Epoxy resins, reactive diluents and curing agents are manufactured and marketed under the trade name Lapox by the Polymers - Performance Materials Business of Atul. It has received ISO 9001:2008 and ISO 14001 certification and has a NABL accredited laboratory for epoxy testing and analysis. The Company is in this business since 1960.

Product range

Resins: Bisphenol-A and Bisphenol-F based resins, Modified and formulated resins, Cycloaliphatic resins, Epoxy phenol novolac resins, Multifunctional resins, Benzoxazine resins, Bismaleimide resins, Brominated resins and Dimer acid based resins

Curing agents: Aromatic amines and adducts, Aliphatic amines and adducts, Cycloaliphatic amines and adducts, Phenalkamines, Polyamides, Polyamidoamines and Sulfones - 3,3'-Diaminodiphenyl sulfone and 4,4'-Diaminodiphenyl sulfone

Reactive diluents: Aliphatic (monofunctional, difunctional and trifunctional), Aromatic (monofunctional and difunctional) and Cycloaliphatic (difunctional)

Accelerators, catalysts and flexibilisers



Filament winding | Pultrusion systems

Atul offers epoxy systems for filament winding and pultrusion processes which are compatible with variety of reinforcements. These systems provide excellent mechanical, electrical, chemical, thermal and physical properties.



Features

- excellent fibre wetting and impregnation properties
- low to moderate viscosity and variable pot life
- moderate to high Tg
- ultraviolet (UV) resistant¹ and fire retardant²
- good chemical and abrasion resistance
- good latency for easy processing
- excellent adhesion and toughness
- amine blush free system available³

Applications

- automotive drive shafts
- composite insulators - rods and tubes
- composite pipes
- fibre reinforced plastic (FRP) rebars
- pressure vessels
 - pressure tubes
 - reverse osmosis (RO) membrane housing
 - RO vessels
 - storage tanks
 - type-4 gas cylinders
- pultruded spar for wind blades

Hot cure

Lapox systems	Mixing ratio (resin : curing agent)	Mix viscosity ⁴ @ 25 °C	Gel time @ 120 °C	Tg ⁵	Recommendations
	parts by weight	mPa s	minutes	°C	
Standard Tg					
L-12 K-12 K-13	100 : 100 : 0.1 - 2.0	450 @ 40 °C	150 @ 80 °C	85 - 95	Fast reactive system that offers good cantilever strength.
ARCH-11 K-3 K-13 ¹	100 : 90 : 0.5 - 2.0	200 - 500	4 - 5	105 - 115	UV resistant system for outdoor applications.
ARL-116 AH-112 AC-18	100 : 90 : 0.1 - 2.0	400 - 600	35 - 45 @ 90 °C	105 - 125	Offers high toughness for type-4 liquefied petroleum gas and compressed natural gas cylinders.
L-247 K-918 K-13 ²	100 : 65 : 1 - 3	1,500 - 3,000	8 - 10	110 - 120	Fire retardant system.
Moderate Tg					
ARL-136 AH-126	100 : 90	300 - 600	4 - 6	115 - 125	Good fibre wetting and high productivity. Suitable for RO pipes and pultruded rods.
ARF-11 K-918 K-13	100 : 85 : 0.1 - 2.0	300 - 500	8 - 11	130 - 140	Good chemical resistance and very low crystallisation tendency at low temperatures.
L-12 K-918 K-13	100 : 85 : 0.1 - 2.0	600 - 900	10 - 12	130 - 140	General purpose composite applications. Replace K-13 with AC-18 for higher productivity and quick Tg development.
High Tg					
L-12 AH-667	100 : 27	3,000 - 5,000	60-70 @ 80 °C	165 - 175	High chemical and abrasion resistance at ambient and elevated temperatures.
L-12 AH-113 K-13	100 : 95 : 0.1 - 2.0	1,900 - 2,100	13 - 15	165 - 185	High temperature endurance system (170 °C).
L-12 K-68 AC-18	100 : 95 : 0.1 - 2.0	1,900 - 2,100	7 - 9	165 - 185	High temperature endurance system with quick Tg development.
L-12 K-5200	100 : 24	4,000 - 6,000	60 - 65	170 - 180	High thermal and chemical resistance for engineering applications.

Ambient cure

Lapox systems	Mixing ratio (resin : curing agent)	Mix viscosity ⁴ @ 25 °C	Pot life ⁶ @ 25 °C	Tg ⁵	Recommendations
	parts by weight	mPa s	minutes	°C	
Standard Tg					
ARL-167 AH-385 ³	100 : 40	800 - 1,200	10 - 15	45 - 50	Fast productive amine blush free system. Suitable for RO membrane.
L-12 AH-714	100 : 50	1,200 - 1,500	120 - 150	55 - 65	Offers excellent adhesion and toughness for pressure vessels.
ARL-135 LV AH-335, AH-336, AH-337	100 : 32	200 - 650	50 - 380	75 - 85	Low viscosity with variable pot life.
L-12 AH-315	100 : 32	500 - 800	7 - 9 hr	85 - 95	Standard system for large components.
L-12 AH-335, AH-336, AH-337	100 : 32	400 - 1,200	50 - 380	90 - 105	Standard system with variable viscosity and pot life.
ARL-138 AH-417	100 : 30	200 - 300	90 - 150	100 - 110	Good wetting properties and resistance to elevated temperatures.
L-12 K-6	100 : 10	5,000 - 8,000	30 - 40	110 - 130	Fast productive standard system.
High Tg					
L-12 AH-422	100 : 32	1,500 - 2,500	300 - 350	130 - 140	Long pot life, excellent chemical resistance and high thermal stability.
L-12 AH-411	100 : 22	800 - 1,200	90 - 120	140 - 155	Low viscosity, excellent chemical resistance and high thermal stability.
L-12 AH-681	100 : 19	2,000 - 3,000	Max. 16 hours	Min. 150	High productivity systems with slow and fast curing agents with excellent chemical resistance.
L-12 AH-682	100 : 24	50 - 100	190 - 230	Min. 155	

⁴Brookfield viscosity | ⁵Tg: glass transition temperature | ⁶Pot life of 100 g mix mass | Mix viscosity: ASTM D2196 | Pot life: ASTM D2471 | Tg: ISO 11375-2

Resin transfer moulding | Resin infusion | Hand lay-up systems

Atul offers epoxy systems for resin transfer moulding (RTM) | resin infusion (RI) | hand lay-up (HLU) processes with variable pot life, cure time, Tg and excellent mechanical properties for manufacturing small to large components including wind turbine blades.



Features

- Det Norske Veritas (DNV) certified
- low and moderate viscosity for good impregnation
- variable pot life options for small to large components
- system with high Tg (up to 140 °C) available

Applications

- aerospace structural parts
- automotive body parts
- boat bodies
- composite repairs
- cooling tower blades
- sporting goods (surfing boards)
- storage tanks
- wind turbine blades and moulds



Lapox systems	Mixing ratio (resin : curing agent)	Mix viscosity ¹ @ 25 °C	Pot life ² @ 25 °C	Tg ³	Recommendations
	parts by weight	mPa s	minutes	°C	
DNV certified					
ARL-125 AH-367	100 : 32	200 - 300	300 - 380	75 - 85	Designed for wind turbine blades and other large components.
ARL-125 AH-365	100 : 32	300 - 700	50 - 60	75 - 85	Preferred for small wind turbine blades and to increase reactivity of slow infusion systems.
ARL-135 AH-334	100 : 32	700 - 1,200	25 - 35	80 - 90	HLU systems with variable pot life and viscosity for wind blades and repairs.
ARL-135 AH-365	100 : 32	300 - 700	50 - 60	70 - 80	
Low viscosity					
ARL-135 LV AH-332	100 : 32	600 - 800	8 - 14	80 - 90	Variable pot life systems for desired cycle time. Suitable for small to large components.
ARL-135 LV AH-333	100 : 32	600 - 750	14 - 20	80 - 90	
ARL-135 LV AH-334	100 : 32	600 - 750	25 - 35	80 - 90	
ARL-135 LV AH-335	100 : 32	300 - 500	50 - 60	75 - 85	
ARL-135 LV AH-336	100 : 32	400 - 650	80 - 100	75 - 85	
ARL-135 LV AH-337	100 : 32	200 - 300	300 - 380	75 - 85	Suitable for small to large cured-in-place pipe (CIPP) application.
ARL-135 LV AH-411	100 : 24	250 - 400	90 - 120	125 - 135	High thermal stability and excellent chemical resistance.
ARL-135 LV AH-422	100 : 32	400 - 600	300 - 350	120 - 140	Long pot life, high thermal stability and excellent chemical resistance.
Medium viscosity					
ARL-135 AH-332	100 : 32	700 - 1,200	8 - 14	80 - 90	Variable pot life systems for desired cycle time. Suitable for small to large components.
ARL-135 AH-333	100 : 32	700 - 1,200	14 - 20	80 - 90	
ARL-135 AH-335	100 : 32	500 - 700	50 - 60	75 - 85	
ARL-135 AH-336	100 : 32	500 - 700	80 - 100	75 - 85	
ARL-135 AH-337	100 : 32	300 - 500	300 - 380	75 - 85	
High performance					
L-552 K-552	100 : 38	600 - 700	110 - 160	115 - 130	Designed for static and dynamic applications including aerospace, tooling and aircraft repairs.

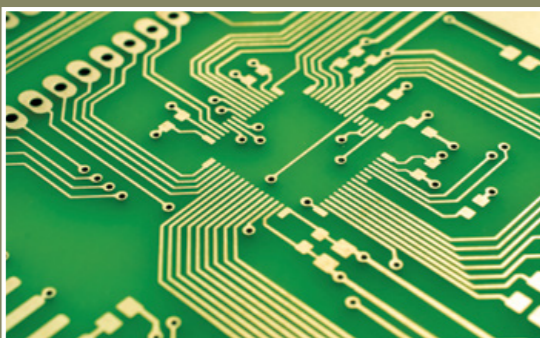
HLU systems

Fire retardant					
ARL-143 AH-319	100 : 15	3,500 - 5,000	18 - 25	95 - 105	Formulated for fire retardant applications.
ARL-143 AH-335	100 : 15	3,500 - 5,000	85 - 95	95 - 105	
Multipurpose					
L-12 AH-714	100 : 50	1,200 - 1,500	120 - 150	55 - 65	Offers excellent adhesion and toughness for FRP products.
L-12 K-6	100 : 10	5,000 - 8,000	30 - 40	110 - 130	Fast reactive system for general purpose composites.

¹Brookfield viscosity | ²Pot life of 100 g mix mass | ³Tg: glass transition temperature | Mix viscosity: ASTM D2196 | Pot life: ASTM D2471 | Tg: ISO 11375-2

Prepregs | Compressed laminates systems

Atul provides epoxy systems for B-stage prepregs with varying shelf life. They have excellent impregnation properties that are compatible with a variety of reinforcements, providing high mechanical strength and thermal resistance.



Features

- high Tg
- easy processability
- flame retardant¹ (FR)
- variable shelf life
- excellent mechanical strength
- high thermal endurance

Applications

- aircraft | drone structural parts
- automotive body parts
- defence equipment (canister and housing)
- FR-4 | G-10 | G-11 laminates
- mica tapes
- sporting goods (hockey sticks and racquets)
- wind blade parts

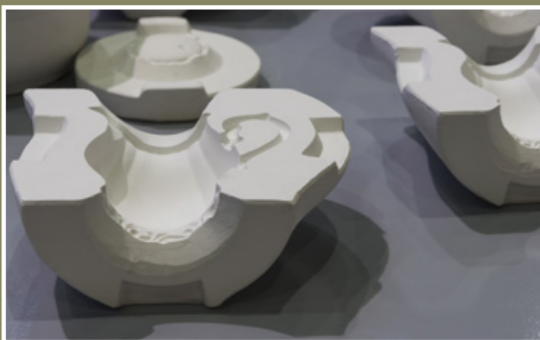
Lapox systems	Mixing ratio (resin : curing agent)	Gel time ² @ 120 °C	Tg ³	Recommendations
	parts by weight	mPa s	°C	
Compressed laminates				
ARPN-36 K-10 K-86	100 : 40 : 1 - 3	7 - 12	205 - 210 ⁴	Suitable for mica paper impregnation.
ARPN-36 K-86	100 : 3 - 6	8 - 12	240 - 245 ⁴	
L-12 K-5	100 : 27	8 - 10	150 - 160	Suitable for manufacturing G-10 and G-11 laminates.
L-12 K-10 K-86	100 : 35 : 1 - 3	19 - 21	150 - 160	Suitable for G-11 laminates. B-staged prepreg offers long shelf life.
L-67 K-66 K-13	100 : 23 : 0.1 - 3.0	7 - 9 @ 150 °C	130 - 140	Suitable for G-10 laminates.
L-68 K-66 K-13	100 : 32 : 1 - 3	7 - 9 @ 150 °C	130 - 140	Suitable for FR-4 laminates.
Hot melt				
ARL-159 AH-357 AC-22	100 : 30 : 1 - 3	4 - 8	155 - 165	Offers extended shelf life of prepregs.
ARL-159 AH-619	100 : 40	30 @ 150 °C	180 - 200	Designed for aerospace, defence and engineering applications.
ARL-160 AH-357 AC-22	100 : 15 : 1 - 3	8 - 9	110 - 120	Moderate Tg ideal for sporting goods, defence, infrastructure and general engineering applications.
Solvent based				
ARL-162 AH-380	100 : 1.5	14-18	90-100	System for sporting goods - hockey sticks and racquets.

Lapox systems	Appearance	Softening point	Viscosity ⁵ @ 25 °C	Recommendations
	visual	°C	mPa s	
Benzoxazines				
ARBZ-10 ¹	Yellowish solid	60 - 80	1,000 - 7,000 ⁶ @ 100 °C	Bis-F based high Tg resin. Provides excellent moisture resistance, good dimensional stability and flame retardancy in advanced composites.
ARBZ-10 A 75 ¹	Yellowish liquid	74 - 76% (solid content)	100 - 400 ⁷	ARBZ-10 solution in acetone with 75% solids.
ARBZ-11	Yellowish solid	60 - 80	50 - 500 ⁶ @ 125 °C	Bis-A based high Tg resin. Provides excellent moisture resistance and good dimensional stability in advanced composites.

²Method: Gel time - DIN 16945 | ³Tg: glass transition temperature; Tg: ISO 11375-2 | ⁴HDT value at 200 °C | ⁵Brookfield viscosity | ⁶Viscosity by CAP 2000 (ASTM D4287) | ⁷Viscosity by ASTM D2196

Tooling systems

Atul offers gel coats in white, grey and blue colours as well as tintable gel coat. The laminating systems have high Tg, variable pot life and viscosity. These are suitable for HLU and RI processes to manufacture small to large moulds | patterns | prototypes.



Features

- excellent hardness and surface finish
- good abrasion resistance
- high thermal stability
- variable pot life and viscosity

Applications

moulds and tools

- automotive
- boat body
- casting
- defence equipment
- general assemblies
- wind blade

Lapox systems	Mixing ratio (resin : curing agent) parts by weight	Mix viscosity ¹ @ 25 °C mPa s	Pot life ² @ 25 °C minutes	Tg ³ °C	Recommendations
Gel coats					
ART-21 AH-326 (T-73 K-51)	100 : 15	Paste	25 - 30	80 - 90	White coloured system providing resilient and machinable surface with good edge strength.
ART-22 AH-326 (T-94 K-51)	100 : 8	Paste	15 - 20	80 - 90	Grey coloured system providing excellent hardness and high thermal conductivity.
ART-23 AH-326 (T-96 K-51)	100 : 10	Paste	15 - 20	80 - 90	Blue coloured system providing abrasion resistance, extreme hardness and good surface finish.
ART-24 AH-326	100 : 15	Paste	15 - 30	95 - 115	Natural milky white tintable system providing machinable surface with high thermal stability.
Laminating systems					
ARL-138 AH-417	100 : 30	200 - 300	90 - 150	100 - 110	Offers excellent fibre wetting enabling high productivity.
L-552 K-552	100 : 38	600 - 700	110 - 160	115 - 130	Designed for static and dynamic applications including aerospace, tooling and aircraft repairs.
ARL-135 LV AH-411	100 : 24	250 - 400	90 - 120	125 - 135	Excellent chemical resistance and high thermal stability.
ARL-125 AH-339	100 : 30	400 - 600	120 - 150	130 - 140	Long pot life and good thermal stability. Suitable for making large tooling components for wind automotive industry.
ARL-138 AH-339	100 : 30	400 - 600	120 - 180	130 - 140	High Tg system for manufacturing tools of varying sizes by HLU and RI.
ART-17 AH-454	100 : 40	200 - 300	480 - 530	155 - 165	Extended pot life with high Tg for medium and large tools.
ARL-140 AH-419	100 : 42	2,500 - 3,000	600 - 700	190 - 220	Outstanding thermal performance. Designed for aerospace, defence and wind blade component tools.

¹Brookfield viscosity | ²Pot life of 100 g mix mass | ³Tg: glass transition temperature | Mix viscosity: ASTM D2196 | Pot life: ASTM D2471 | Tg: ISO 11375-2

Adhesive systems

Atul presents a variety of epoxy adhesives with variable viscosity and pot life for joining similar | dissimilar substrates. These adhesives provide excellent bonding strength to meet high performance requirements.



Features

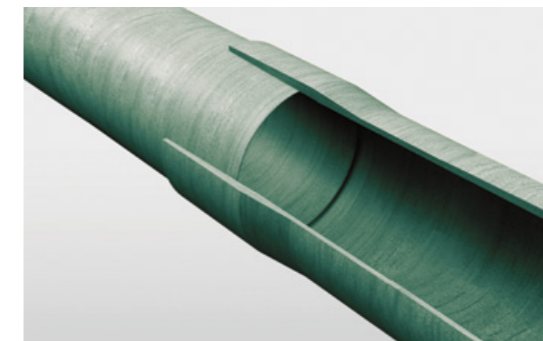
- thixotropic and non-sagging
- slow and fast curing
- excellent adhesion to metal, non-metal and composite substrates
- resistant to shock, impact and vibrations
- high lap shear strength

Applications

- automotive components
- engineering applications
- FRP pipes
- flexible cable joints
- wind turbine blades

Lapox systems	Mixing ratio (resin : curing agent)	Mix viscosity ¹ @ 25 °C	Pot life ² @ 25 °C	Recommendations
	parts by weight	mPa s	minutes	
Multipurpose				
A-16 AH-800	100 : 100	8,000 - 12,000	3 - 7	Rapid cure adhesive for bonding similar dissimilar substrates (5 - 7 minutes).
A-31 K-31	100 : 80	30,000 - 35,000	75 - 90	Suitable for bonding glass, metal, FRP and wood with high shear strength requirements (up to 120 kgf/cm ²).
A-83 K-83	100 : 40	10,000 - 20,000	60 - 80	Standard system with thixotropic properties to fill gaps up to 5 mm.
FRP pipe joint				
ARA-44 AH-386	100 : 25	Paste	40 - 50	High temperature and chemical resistant system.
Specialty				
ARA-41 AH-448	100 : 50	60,000 - 75,000	20 - 30	For FRP-FRP and FRP-metal bonding.
XR-110 XH-68	100 : 100	2,500 - 5,000	30 - 45	For flexible cable joints at ambient temperature.
Wind blade				
ARA-32 AH-733	100 : 45	300 - 400	55 - 65 @ 30 °C	Thixotropic structural adhesives with high lap shear strength suitable for blade shell bonding.
ARA-32 AH-735 ³	100 : 45	300 - 400	120 - 180 @ 30 °C	

¹Brookfield viscosity | ²Pot life of 100 g mix mass | ³DNV certified system | Mix viscosity: ASTM D2196 | Pot life: ASTM D2471



Product selection guide

System	Processes						Applications						
	Filament winding	Hand lay-up	Pultrusion	Prepreg	Resin infusion	Resin transfer moulding	Adhesives	Aerospace and Defence	Electro-composites	Pressure vessels and Pipes	Sports and Leisure	Tooling	Wind blades
L-12 K-12 K-13	•		••			•			••	•			
ARCH-11 K-3 K-13	•		••						••				
ARL-116 AH-112 AC-18	••		•							••			
L-247 K-918 K-13	•		•			•		••					
ARL-136 AH-126	••		•			•		•	••	•			
ARF-11 K-918 K-13	•		•			•		•	•				
L-12 K-918 K-13	••		••			•		••	•				
L-12 AH-113 K-13	••		••			•		••	•				
L-12 AH-667	••		•			•			••				
L-12 K-68 AC-18	••		••			•		••	•				
L-12 K-5200	•	••	•			•						••	
ARL-167 AH 385	••		•						••				
L-12 AH-714	•	••	•					•	•	•			
ARL-135 LV AH-335	•	••	•		•	•	•		•	•	•	•	••
ARL-135 LV AH-336	•	••	•		•	•	•		•	•	•	•	••
ARL-135 LV AH-337	•	••	•		•	•	•		•	•	•	•	••
L-12 AH-315	•	•	•			•					••		
L-12 AH-335	•	•	•								••		
L-12 AH-336	•	•	•			•					••		•
L-12 AH-337	•	•	•		•	•					••		•
ARL-138 AH-417		•			•	•						••	•
L-12 K-6	•	••					•		•			•	•
L-12 AH-422	•	•	•			•				•	•		
L-12 AH-411	•	•	•			•			•		•		
L-12 AH-681	•		•						••				
L-12 AH-682	•		•						••				
ARL-125 AH-367 ¹	•	•	•		••	•	•			•	•	•	••
ARL-125 AH-365 ¹	•	•	•		••	•	•			•	•	•	••
ARL-135 AH-334 ¹		••			•	•	•			•	•	•	••
ARL-135 AH-365 ¹	•	••	•		•								••
ARL-135 AH-332		••			•	•	•			•	•	•	••
ARL-135 AH-333		••			•	•	•			•	•	•	••
ARL-135 AH-335	•	••	•		•	•	•			•	•	•	••
ARL-135 AH-336		•			•	•	•			•	•	•	•
ARL-135 AH-337	•	•	•		••	•	•			•	•	•	••
ARL-135 LV AH-332		••			•	•	•			•	•	•	•

¹DNV certified system | •• Highly recommended | • Recommended

Product selection guide

System	Processes						Applications						
	Filament winding	Hand lay-up	Pultrusion	Prepreg	Resin infusion	Resin transfer moulding	Adhesives	Aerospace and Defence	Electro-composites	Pressure vessels and Pipes	Sports and Leisure	Tooling	Wind blades
ARL-135 LV AH-333		••			•	•		•			•	•	•
ARL-135 LV AH-334		••			•	•		•			•	•	•
ARL-135 LV AH-411	•		•		•	•		•			•	•	
ARL-135 LV AH-422	•		•		•	•		•			•	•	
ARL-143 AH-319		••						•					
ARL-143 AH-335		••						•					
L-552 K-552	•	•				•					•		
ARPN-36 K-10 K-86									••				
ARPN-36 K-86									••				
L-12 K-5	•	•	•						•	•	•		
L-12 K-10 K-86									••				
L-67 K-66 K-13									••				
L-68 K-66 K-13									••				
ARL-159 AH-357 AC-22									•		•		
ARL-159 AH-619									•		•		
ARL-160 AH-357 AC-22									•		•		
ARL-162 AH-380											••		
ARBZ-10									••				
ARBZ-11									••				
ARBZ-10 A 75									••				
ART-21 AH-326		••										••	
ART-22 AH-326		••										••	
ART-23 AH-326		••										••	
ART-24 AH-326		••										••	
ARL-125 AH-339		•			•							••	
ARL-138 AH-339	•	•			•	•						••	
ART-17 AH-454		•			•							••	
ARL-140 AH-419	•	•				•						••	
A-16 AH-800		•							••				
A-31 K-31		•							••				
A-83 K-83		•							••				
ARA-32 AH-733		•							••		•		••
ARA-32 AH-735		•							••		•		••
ARA-41 AH-448		•							••		•		
ARA-44 AH-386		•							••		••		
XR-110 XH-68		•							••				

•• Highly recommended | • Recommended