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AM-2228-A1 Engine Cradle AM-2228-C1 Base with AGSE-E029-G02/-G03 Pneumatic Tire Axle Option

Ref. IAE6R18897

Engine Handling System For V2500-A1/A5 Engines Used On A320/A321 Aircraft

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1.0 – Revisions

DESCRIPTION OF CHANGE PAGE REV DATE 8.3 E Updated Part Number Item 15, 17, 18, 19, 20 7/13/2023 8.4 Е Updated Part Number Item 25, 27, 55 7/13/2023 8.4 E Addd Item 67, 68 & 69 7/13/2023 8.5 E Updated Figure 8.2-1 7/13/2023 8.6 Е Updated Figure 8.2-2 7/13/2023 8.7 Е Added Figure 8.2-3 7/13/2023 E 8.8 Updated Part Number Item 4 7/13/2023 8.8 Е Updated Figure 8.3-1 7/13/2023 8.9 Е Updated Part Number Item 35, 37, 45 & 46 7/13/2023 8.9 Е Removed Item 36, 47, 55 7/13/2023 8.9 Е Added Item 61-65 7/13/2023 8.10 Е Updated Figure 8.4-1 7/13/2023 8.11 E Added Figure 8.4-2 7/13/2023 8.13 E Updated Figure 8.5-1 7/13/2023

The following is an itemized record of all changes from previous revision.

2.0 – Illustration





3.0 – Specification

CAUTION

The Pneumatic Tire Axle Option is to be used only with the AM-2228-C1 Base.

3.1 General

The AM-2228-A1/C1 Engine Handling System is designed to transport, and/or store the International Aero Engines (IAE) V2500-A1/A5 engine in QEC configuration. The engine handling system is compliant with IAE specification IAE6F10000 (air/road shipping stand, V2500 engine). It is capable of being shipped (with engine) in the main deck cargo bays of the B747F, Transall, "L"-100 Hercules, CL44 aircraft. Engine pins securely into place quickly and easily. Bootstrapping capabilities have been incorporated into the cradle design. A document container is secured to the Cradle for all manuals and documents.

3.2 Mobility

The transport base consists of a frame weldment supported by four shock absorbing caster assemblies. Each caster assembly offers a 5 inch wide by 10 inch diameter wheel for easy mobility and a weight capacity of 5,000 pounds each. Polyurethane tread wheels, position locks, and face brakes are standard. All four caster assemblies are designed to pin in an elevated position for air/ truck transport of the entire unit, with engine. The towbar stows on the base frame when not in use. Maximum towing speed of the unit is 5 km/hr (3 MPH). Built-in shock absorbing mounts cushion all transport shocks and vibrations. A series of tie-down rings offer secure retainment during transportation of unit.

CAUTION

Failure to unlock the lead casters (towbar end) during towing of the unit will result in flat spots being worn into the caster tread.

AGSE-E029 pneumatic tire axles are optional. They offer a towbar, parking brakes, and a tire size of 9.00-10 ply (27 inch diameter). The AGSE-E029-G02 includes standard pneumatic tires and the -G03 version includes foam filled tires. With the pneumatic tire option the maximum towing speed is 10 MPH.

CAUTION

Failure to release the parking brakes will result in flat spots being worn into the tires.

3.3 Cradle (AM-2228-A1)

Designed to securely and safely hold for transport of the V2500 engine.

3.4 Base (AM-2228-C1)

The unit is designed to securely and safely transport the AM-2228-A1 cradle and V2500-A1/A5 engine. The unit is designed with four retractable, shock-absorbing caster wheels for ground mobility and buit-in shock mounts for truck shipping.

3.5 Construction and Finish

Fabricated from structural steel shapes conforming to ASTM A500, A513 and A36 materials. All bolted connections use A325 structural bolts or grade 5 commercial hardware. The unit is primed and painted with high grade, Skydrol resistant, air-dry enamel, with optional colors. Pins and miscellaneous hardware are manufactured from corrosion resistant materials, or plated as required.

3.6 Characteristics

	With Engine	Without Engine	
Height	102.0 inches	62.0 inches	
Width	96.0 inches	96.0 inches	
Length	231.0 inches	231.0 inches	
Weight	11,910 pounds	5,500 pounds	
Engine CL Height	58.5 inches	N/A	

4.0 – Maintenance and Inspection

4.1 General

Life expectancy of this unit can be extended if it is properly maintained. By design, there is only minimal periodic servicing required. Annual inspections for damage, weld cracks, or corrosion are recommended. Prior to each use, the stand should be inspected for obvious signs of abuse or shipping damage. Observed damage should require complete inspection of the affected area to ensure stand integrity is not compromised.

4.2 Cleaning and Painting

The stand should be cleaned with a soap and water solution and rinsed thoroughly.

WARNING

Re-lubricate all grease zerk fittings after cleaning stand.

Damaged paint should be touched-up with paint provided by AGSE or other Skydrol resistant high-grade enamel paint. Superficial scratches are expected during normal usage and will not affect function.

4.3 Scheduled Service

All casters should be lubricated every 90 days with the following extreme pressure grease or equivalent grease:

Mobil Oil Company	Mobilplex E.P. #1
Texaco Oil Company	Texaco E.P. #1
Gulf Oil Company	Gulf Crown E.P. #1
Shell Oil Company	Shell Alavania E.P. #1

Visual inspection of the swivel locks and brakes should occur with the scheduled lubrication. All non-painted machined surfaces should have a light grade oil spray as required. Spray with aerosol lubrication WD-40 or equivalent.

The AGSE-E029-G02/G03 tire pressure should be checked every 90 days and re-inflated to 85 PSI.

4.4 Scheduled Inspection

WARNING

Prior to each use, the stand should be inspected for obvious signs of abuse or shipping damage. Observed damage should require complete inspection of the affected area to ensure stand integrity is not compromised.

Annual inspections of machined surfaces, pins, fasteners, structure, and shock mounts are recommended. The machined surfaces (pivots, axles, mounts) are to be visually inspected for signs of wear or corrosion. Action is to be taken immediately if areas are determined to be potentially dangerous to operating personnel, or a detriment to the equipment. Pins and fasteners are to be visually inspected for cracks, damage, or corrosion. Loose fasteners should be tightened. The stand structure is to be visually inspected for damage, weld cracks, or corrosion. The shock mounts are to be visually inspected for date stamp, deterioration, disbond from the mounting plate, or permanent deformation. The shock mount manufacturer recommends replacement after five (5) years of service.

CAUTION

Periodic inspections should be made and shock mounts must be replaced when any of the following conditions exist:

- 1. Shock mount is in service for more than five (5) years.
- 2. There is visible evidence of cracks.
- 3. There are discolorations or deformations.
- 4. Mount does not move or adjust during loading/unloading.
- 5. There is dis-bonding of the rubber mount from the shock attach plate.

5.0 - Operations

5.1 Engine Installation into Stand Using Overhead Sling

- 1) Inspect stand for obvious damage.
- 2) Install the forward engine mounts to the engine using the hardware provided.
- 3) Position the stand beneath the engine and set the caster brakes.

CAUTION

Minimal clearance exist between the engine and stand. The operator is responsible to ensure the engine does not contact the stand. This may require the removal or adjustment of engine components.



Care must be taken when working near suspended loads. Personnel should never stand beneath the suspended load.

- 4) Lower engine into stand until the trunnions slide into the saddles located on the FWD arms. Align the AFT mounts to mate with the AFT engine ground handling points. This may require the stabilizing jacks located beneath the rocker arm to be extended. Continue to lower the engine until the FWD trunnions rest fully in the saddles and the inboard saddle pins can be installed. Adjust the AFT mounts as required to mate with the AFT engine ground handling points. Install clevis pin and safety clip.
- 5) Retract the stabilizing jacks on the AFT rocker beam.

CAUTION

The stabilizing jacks must be retracted after the engine is installed. The turnbuckles located on the AFT arms must also be in the stowed position. Never move the stand (with engine) with the stabilizing jacks or turnbuckles installed.

- 6) Lower engine completely so that the stand supports the full weight of the engine.
- 7) Reinstall turnbuckles and adjust by hand ensuring that they remain loose enough that they do not impart any load into the engine.
- 8) Tighten locking nuts on turnbuckles.
- 9) Extend the stabilizing jacks until they just touch the base, ensuring that they are not imparting any load into the engine.
- 10) Tighten the locking nuts on the stabilizing jacks to prevent their position does not alter.
- 11) Remove engine sling.

5.2 Pneumatic Tire Axle Installation

- 1) Remove caster and caster adapter by removing pin collars and pins.
- 2) Install the pneumatic tire axle using pins and collars from the caster adapters.



The axle assembly with the brake handle must be installed on the AFT end of the stand.

5.3 Engine Bootstrapping

- 1) Inspect stand for obvious damage.
- 2) Telescope the AFT arms downward.
- 3) Disconnect the AFT arm turnbuckles and rotate the AFT arms outward.
- 4) Position the stand beneath the engine by starting FWD of the engine moving AFT.
- 5) Once beneath the engine, rotate the AFT arms inward and pin the AFT upper arms in the raised position.
- 6) Connect the engine hoists to the bootstrap points on the stand.
- 7) Remove the ground handling mounts from the container attached to the stand.
- 8) Install the FWD engine mounts to the engine using the hardware provided.
- 9) Raise the empty cradle.

WARNING

Care must be taken when working near suspended loads. Personnel should never stand beneath the suspended load.

- 10) Raise the empty cradle until the trunnions slide into the saddles located on the FWD arms. Align the AFT mounts to mate with the AFT ground handling points. This may require the stabilizing jacks located beneath the rocker arm to be extended. Continue to raise the cradle until the FWD trunnions rest fully in the saddles and the inboard saddle pins can be installed. Adjust the AFT mounts as required to mate with the AFT engine ground handling points. Install clevis pin and safety clip.
- 11) Retract the stabilizing jacks on the AFT rocker arms.
- 12) Lower the engine and cradle.

5.4 Caster/Pneumatic Tire Axle Height Adjustment

NOTICE

Use a forklift or equivalent to raise and support the stand. This will ease the removal of pins and rotation of axles.

The following illustrations show the procedure for adjusting the stand height. The holes on the stand are labeled for identification as follows: on the base they are labeled 1,2,3, etc.. on the axles they are labeled A, B, C, respectively (Illustration Figure 5.4-1). This section will be showing the raising of the stand height. Lowering the stand is accomplished by following the same procedure in reverse order.

WARNING

Care and common sense should be exercised when operating a forklift or any other machinery. Set brakes on wheels/casters before lifting stand. When re-inserting pins, be certain to also re-insert the safety clips after each step to avoid accidents.



Figure 5.4-1

5.4.1 FWD Axle

 Remove pin from the first position (holes A, 1) and rotate the axle up using the second position (holes B, 2) as a pivot point. (You may use a pallet lift for easier positioning). (Illustration Figure 5.4.1-1).



Figure 5.4.1-1 FWD Axle - First and Second Position Holes

2) Align hole C with hole 1 for the third position and re-insert pin. (Illustration Figure 5.4.1-2).



Figure 5.4.1-2 FWD Axle - Third Position Holes

3) Remove pin from the second position (holes B, 2 in Illustration Figure 5.4.1-1) and lower the axle to line up with the fourth position (holes D, 2) and re-insert pin. (Illustration Figure 5.4.1-3).



Figure 5.4.1-3 FWD Axle - Fourth Position Hole

4) Repeat steps 1 through 3 for the opposite side. Make sure all the pins and safety clips are installed properly and continue on to Section 5.4-2 for the AFT end of the stand.

5.4.2 AFT Axle

 Remove pin from the first position (holes A, 1) and rotate the axle up using the second position (holes B, 2) as a pivot point. (You may use a pallet lift for easier positioning). (Illustration Figure 5.4.2-1).



Figure 5.4-2-1 AFT Axle - First and Second Position Holes

2) Align hole C with hole 3 for the third position and re-insert pin. (Illustration Figure 5.4.2-2)



Figure 5.4.2-2 AFT Axle - Third Position Holes

3) Remove pin from the second position (holes B, 2 in Illustration Figure 5.4.2-1) and lower axle to line up with the fourth position (holes A, 4) and re-insert pin. (Illustration Figure 5.4.2-3).



Figure 5.4.2-3 FWD Axle - Fourth Position Holes

4) Repeat steps 1 through 3 for the opposite side. Make sure all pins and safety clips are installed properly.

6.1 Stress

Design stress safety factors are compliant with industry standards.

6.2 General

Most accidents are the result of violating standard safety rules in operation or improper servicing and maintenance of equipment.

Many safety features have been incorporated into the design to assist in safe operation of this equipment. These items do not fool-proof the equipment nor do they replace the operator's responsibility to operate the equipment in a safe manner.

6.3 Prevention

A good preventative maintenance program should include periodic lubrication, adjustment, and immediate correction of defects revealed through inspections. Preventive maintenance will not only contribute to safe operation, but will also extend useful service life as well.

6.4 Risk Assessment

6.4.1 Limits of the Machinery

The AM-2228-A1/C1 Engine Shipping Stand (AM-2228-A1Cradle/AM-2228-C1 Base) is a commercial product designed to transport and/or store the IAE V2500-A1/A5 engines. It is not anticipated that the equipment will be used or misused for other purposes. The equipment is to be used by trained mechanics free from physical impairment and who are familiar with this or similar engine cradles. The equipment is not to be used or made available to the general public.

6.4.2 Risk Assessment and Residual Risk

The risk assessment performed was based on objective observation based on the experience of AGSE with similar equipment. Necessary Warning and Caution Notes have been incorporated into the Operation Section of the Engine Shipping Stand Operation manual along with instructions. Stencils also have been put on the equipment to identify hazardous and/or potential risk areas.

The operation of the Engine Shipping Stand is considered safe to use when all instructions are followed and cautions/warnings are heeded. Low residual risks include potential pinch points during operation of the equipment.

Equipment detailed in this manual has undergone risk assessment using methods and standards set forth within European Standard EN 1050 and is considered to be safe for its intended use. Reports on risk analysis and evaluation according to 2006/42/EC Machinery Directive (17 May 2006) are available upon request.





EC DECLARATION OF **C**ONFORMITY

The machinery listed below fulfills all relevant provisions of the directives listed:

2006/42/EC Machinery Directive (2006/05/17) •

Machinery covered by this Declaration:

Description:	Engine Handling System, V2500-A1/A5
Model:	AM-2228
Part Number:	AM-2228-A1
	AM-2228-C1
Serial Number:	

Harmonized Standards:

- ISO 12100:2010 Safety of Machinery General Principles for Design Risk Assessment and Risk Reduction
- ISO/TR 14121-2:2012 Safety of Machinery Risk Assessment Part 2: Practical Guidance and Examples of Methods

Standards and Specifications:

- IAE6R18897, Stand Without Roll Transfer, 1993/10/20 REV NC
- AGSE Quality System Procedure Number QSP-006
- Aerospace Recommended Practice Standard, SAE ARP 1840, 2007/02 Rev B

Place:

Santa Fe Springs, California, USA

Date:

Signed:

Quality Representative

Technical File: Pedro Fernandes Advanced Ground Systems Engineering Pct Ana Maria Bastos, N20 A-dos-Cunhados, Portugal 2560-005 +351-96-520-4851

7.0 – Warranty

7.1 Statement of Warranty

Advanced Ground Systems Engineering LLC (AGSE) warrants to original purchasers that it's products will be free of defects in material and workmanship under normal use and conditions for claims received within a period of one year from date of purchase (final billing date), and to the extent that if any AGSE product fails in operation because of such defect, the company will replace or repair, at its option, the defective article. Prior to the repair or replacement of any defective product, the company shall be notified in writing as to the nature of the defect. The company shall assume no liability for freight, disassembly, removal, refitting and installation charges on any article returned unless such charge(s) is approved by AGSE in writing prior to the return. On component items purchased by AGSE for incorporation into an AGSE manufactured product, only the component manufacturer's warranty (if any) shall apply to that component. Said manufacturers warranty shall be passed on to AGSE's customer to the extent permitted. This warranty is applicable only when AGSE products are operated for intended purposes within the recommended procedures, load limits, properly maintained, not damaged or abused, etc., including as indicated in company manuals, catalogs, and drawings. All warranty claims must be applied for within sixty days from when the defect becomes known. The foregoing warranty is in lieu of all other warranties, or liabilities, either expressed or implied, and AGSE expressly excludes all implied warranties of merchantability and fitness for a particular purpose and all non-infringement warranties as well as disclaims all liabilities to third parties. In no event shall AGSE be liable for any amounts in excess of the purchase price of the product.

NOTICE

Failure to conduct periodic inspections, routine maintenance, or improper operation will result in the voiding of the warranty.

8.0 – Parts Breakdown

8.1 General

The following pages can be used in the identification of components used in the product described in this manual. Parts Lists are broken down by "ITEM," "PART NUMBER," "QTY," and "DESCRIPTION."

NOTICE

"ITEM" numbers are for reference to the Illustrated Parts Breakdown (IPB) only. Do not order replacement parts by "ITEM" number. Order parts by "PART NUMBER" only.

8.2 Illustrated Parts Breakdown

IPB Figure 1 – AM-2228-A1/C1 Transportation Stand Assembly

ITEM	PART NUMBER	QTY	PART DESCRIPTION
	AM-2228-A1/C1	-	Transportation Stand Assy (Illustration Figure 8.1-1)
1	AM-2228-A1	1	Cradle Assy (See IPB Figure 2 for Details)
2	AM-2228-C1	1	Base Assy (See IPB Figure 3 for Details)
3	AGSE-E029-G01	1	Pneumatic Tire Axle Assy (See IPB Figure 4 for Details)



Figure 8.1-1

IPB Figure 2 – AM-2228-A1 Cradle Assembly

ITEM	PART NUMBER	QTY	PART DESCRIPTION
	AM-2228-A1	-	Cradle Assy (Illustration Figure 8.2-1)
1	AM-2228-A3	1	Cradle Weldment
2	AM-2228-A6	1	Tube Weldment
3	AM-2228-B6	2	AFT Mount Bracket
4	AM-2228-C6	2	AFT Mount
6	AM-2228-E6	2	Retainer Plate
7	AM-2228-F6	2	Retainer Pin
8	AM-2228-C8	2	FWD Mount Shaft
9	AM-2228-D8	3	Round Bar
10	AM-2228-E8	2	Rod Thread
11	AM-2228-F8	2	Hold Down Bar
14	AM-2228-K8	2	Safety Pin
15	AGSE-S00104-16C072A02	1 2	Screw, Hex Head
16	AM-2228-A10	1	Mount Assy (See IPB Figure 3 for Details)
17	AGSE-S00118-12C032A07	2	Screw, Socket Head
18	AGSE-S00118-08C016A07	8	Screw, Socket Head
19	AGSE-S00118-08F044A07	8	Screw, Socket Head
20	AGSE-S00150-12CA05	6	Nut
21	13SF22	2	Spherical Bearing
22	AM-2228-M8	2	Washer - Steel Finished - 25/32" ID - 1-1/2" OD x 1/4" Thk
23	CL-4-BLPT-2.00-S	2	Ball Lock Pin
24	L-3	2	Leveling Pad -3/4"-10UNC

IPB Figure 2 – AM-2228-A1 Cradle Assembly (Continued)

ITEM PART NUMBER QTY PART DESCRIPTION

- 25 AGSE-S00170-125D024A05 2
- Slotted Spring Pin
 - HG-2510/4037 2 Take-up Jaw & Jaw (5,200)
- 27 AGSE-S00131-16A17
- 28 AM-220750 AM-90750-64L

26

- 51 AM-2228-G6
- 55 AM-90625-33L
- 67 AGSE-S00135-16A17
- 68 AGSE-S00135-08A17
- 69 AGSE-S00166-250D024A17 6
- 70 AM-90750-64T

- 6 Washer
- 2 "AGSE" Name Plate
- 4 Safety Pin

2

- Spindle Adapter (Optional)
- 2 Safety Pin Assy
- 2 Washer, Locking
- 16 Washer, Locking
- 6 Cotter Pin
 - 2 Safety Pin









Figure 8.2-3

Page 8.7

IPB Figure 3 – AM-2228-A10 FWD Mount Assembly

ITEM	PART NUMBER	QTY	PART DESCRIPTION
	AM-2228-A10	-	FWD Mount Assy
			(Illustration Figure 8.3-1)
1	AM-2228-D10	1	Mount Bracket
2	AM-2228-E10	1	Mount Bracket - Opposite
3	97345A531	2	Shoulder Screw -1/4"-24 UNC x 3/8" Lg
			18-8 SS
4	AM-2228-F10	4	Hex Head Bolt
5	AM-2228-B10	1	Slide Plate
6	AM-2228-C10	1	Slide Plate - Opposite





IPB Figure 4 – AM-2228-C1 Base Assembly

ITEM	PART NUMBER	QTY	PART DESCRIPTION
	AM-2228-C1	-	Base Assy (Illustration Figure 8.4-1)
30	AM-2228-A7	1	FWD Cross Member
31	AM-2228-B7	2	AFT Cross Member
35	AGSE-S00304-P04	8	Shock Mount
37	S00105-08F016A01	64	Screw, Hex Head
38	CL-12-BLPT-3.50	4	Ball Lock Pin
39	AM-91500-160T	8	Safety Pin
43	PMP-10111	16	Tie-down Ring - 10,000 Lb Cap
45	AGSE-V164-S01	1	Document Box
46	AGSE-S00175-08A17	64	Flat Washer
49	AM-2207	2	"AGSE" Name Plate
52	AM-2228-B5	1	Base Weldment
60	AGSE-S00104-04F014A01	4	Screw, Hex Head
61	AGSE-S00135-04A17	4	Washer, Locking
62	AGSE-S00131-04A17	8	Washer
63	AGSE-S00114-04C016A27	74	Screw, Flat Head
64	AGSE-V16402-P01	1	Bracket Adapter
65	AGSE-S00153-04CA01	4	Nut



Figure 8.4-1



IPB Figure 5 – AGSE-E029-G02/G03 Rubber Tire Axle Kit

ITEM	PART NUMBER	QTY	PART DESCRIPTION
	AGSE-E029-G01	-	Rubber Tire Axle Kit (Illustration Figure 8.5-1)
	AGSE-E029-G02	-	Rubber Tire Axle Kit (Illustration Figure 8.5-1)
	AGSE-E029-G03	-	Rubber Tire Axle Kit (Illustration Figure 8.4-1)
4	94-105	1	Running Gear Assy (Alt Hadco P/N 560116)
5	94-106	1	Running Gear Assy (Alt Hadco P/N 560116)
6	AGSE-E02902-P01	1	FWD Axle Bracket
7	AGSE-E02902-P02	1	AFT Axle Bracket
8	AM-90500-96T	1	Safety Pin Assy
9	9.00 x 10 NHS	4	"Mighty Mover" Wheel and Rim (Used on AGSE-E029-G02)
10	9.00 x 10 MOD	4	Foam Filled Tire (Used on AGSE-E029-G03)
11	AM-90937-176	1	Safety Pin Assy
12	B27083AZKT	2	Clevis Assy
13	Commercial	2	Hex Nut - 5/16"-24UNF - Zinc Plt
14	Commercial	1	Threaded Rod - 5/16"-24UNF - Zinc Plt
15	Commercial	4	Hex Nut - 3/8"-16UNC - Zinc Plt



9.0 - Stencils, Decals, and Placards

9.1 General

Various stencils, decals, and placards are added to the equipment to provide warnings, cautions, and general information. These items should be reviewed and understood by maintenance and user personnel.

10.0 - Recommended Spares

10.1 Critical Items

AGSE defines "critical" items as those items, if broken or missing, that would render the equipment inoperable or severely impair equipment operation. Since most of these items are also long leads, it is AGSE's recommendation that such items be identified, purchased, and stocked by the customer. In the remote event of "critical" item failure, the equipment can be quickly repaired and placed back in service with minimal down time.

AGSE does not typically stock all components used with the equipment, so immediate shipment of "critical" items may not always be possible. AGSE will respond to customer requests for quotation on any spare parts, and expedite orders for spare parts as required. The customer should never assume immediate delivery is always possible.

It is the responsibility of the operator of the equipment to review the recommended spares list and balance costs against equipment down-time. The list can be adjusted by the operator based on the actual service life of components experienced during equipment usage.

PART NUMBER	QTY	PART DESCRIPTION
AM-2228-C6	1	Aft Mount
AM-2228-F6	1	Retainer Pin
AM-2228-K8	1	Safety Pin
CL-4-BLPT-2.00-S	1	Ball Lock Pin
CL-12-BLPT-3.50	1	Ball Lock Pin
AM-91500-160T	1	Safety Pin
AM-9500-22T	1	Safety Pin
AM-9750-64L	1	Safety Pin