## THE RIGHT CONNECTIONS FOR THE RIGHT RESULTS

**Airdrome Precision Components** 

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## HOW TO ORDER

**STEP 1.** Select the type of fitting configuration in the chart that suite your requirement.

**STEP 2.** Refer to the technical data for your system design information.

**STEP 3.** The example of part number shows how to order fittings by the complete part number.

## This is one of our catalogs ( ) as shown below:

(A)	Boss Fittings.	(K)	Metric Boss Fittings.
(B)	<ul><li>37 deg. Flared Fittings.</li><li>37 deg. Seal Ring Fittings.</li><li>37 deg. Flared to Boss Adapters.</li></ul>		
(C)	Lt-wt 24 deg. Flareless Fittings. Standard 24 deg. Flareless Fittings. Standard 24 deg. Flareless to Boss Adapters. Standard 24 deg. Flareless to 37 deg. Flared Adapter	(L) rs.	Metric Lt-wt 24 deg. Flareless Fittings. Metric 24 deg. Flareless to Boss Adapters.
(D)	DualISeal Fittings. DualISeal to Boss Adapters. DualISeal to 37 deg. Flared Adapters. DualISeal to 24 deg. Flareless Adapters.	(M)	Metric DualISeal Fittings. Metric DualISeal to Boss Adapters.
(E)	Orbital Tube Weld Fittings. Orbital Tube Weld to Boss Adapters. Orbital Tube Weld to 37 deg. Flared Adapters. Orbital Tube Weld to 24 deg. Flareless Adapters. Orbital Tube Weld to DualISeal Adapters.	(N)	Metric Orbital Tube Weld Fittings. Metric Orbital Tube Weld to Boss Adapters. Metric Orbital Tube Weld to Boss Adapters
(F)	Tube Braze Fittings. Tube Braze to 37 deg. Flared Adapters. Tube Braze to 24 deg. Flareless Adapters.		
(G)	Shape Memory Tube Fittings. Shape Memory Tube to 24 deg. Flareless Adapters. Shape Memory Tube to DualISeal Adapters.		
(H)	Ext-Swage Fittings (rated 3,000 psi). Ext-Swage to Boss Adapters (rated 3,000 psi). Ext-Swage to 37 deg. Flared Adapters (rated 3,000 p Ext-Swage to 24 deg. Flareless Adapters (rated 3,000 Ext-Swage to Duall/Seal Adapters (rated 3,000 psi).	psi). O psi).	
	Ext-Swage Fittings (rated 4,000 psi). Ext to 24 deg. Flareless Adapters (rated 4,000 psi).	(P)	Metric Ext-Swage Fittings (rated 28 Mpa). Metric Ext-Swage to 24 deg. Flareless Adapters (rated 28 Mpa). Metric Ext-Swage to Dual/Seal Adapters
(J)	Int-Swage to DualISeal Adapters. Int-Swage to 24 deg. Flareless		(rated 28 Mpa).

## **BOSS SEPARABLE FITTING**



#### **DESIGN CONCEPT:**

The concept of MS33649 Boss design provides an internally threaded port to mate with fittings for use in extreme tight areas. The design of the Boss accommodates mating with Straight threaded fitting end as well as Flared or Flareless fitting ends. An O-ring that is installed on the hex face of the mating fitting end and compressed against the front seat of the Boss surface accomplishes sealing.

In the case of shape fittings such as elbow, tee and cross configurations. A tight fit washer supported by a jam nut is assembled on the externally threaded port for securing the O-ring. As an option, externally threaded Flared or Flareless bulkhead fitting ends can also be used as alternative fitting ends. Position the fitting within the final turn of the last thread engagement and then tighten the jam nut on the washer to effect O-ring sealing.

O-ring materials shall be selected based on compatibility with system fluid and temperature requirements. An option is given on straight fitting connections by utilizing the one-piece externally threaded fitting end with an integral metal seal on the hex face. This concept allows the fitting joint to withstand any system fluid and temperature range that is compatible with the system tubing materials being used.

This design concept is handy for fluid connections on actuators, instrument gages, manifolds, pumps, reservoirs, etc. It is also an ideal fitting design for drainage purpose as well.

### **DESIGN ADVANTAGES:**

- Sealing efficiency is accomplished by changing new O-ring per each repeated usage. Thus, wear and tear of both mating fittings are kept to minimum to reduce down time and high repair cost.
- Assembly of Boss connections can be made in place for production and repair applications.
- Design concept allows fitting connections be installed in extreme tight areas.
- Fittings are available in Cres, Titanium Alloy and Aluminum Alloy materials which are virtually compatible for use with just about any tube materials.
- No special tooling is required except standard torque wrenches for fitting installation.

## STANDARD PROCUREMENT SPECIFICATION FOR BOSS FITTINGS

SAE AS4842 or Military MIL-F-5509 specifications define Form, Fit, Function and Procurement requirements for Boss fittings.

## APPROVAL STATUS

Airdrome fittings are approved for use in various military and commercial programs at Allison, Boeing, Canadair, DeHavilland, General Electric, Northrop/Grumman, etc.

## FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with various tubing materials, fluid and operating temperature:

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928.
Cres	Code J	Indicates 304 per AMS-QQ-S-763.
	Code K	Indicates 316 per AMS-QQ-S-763.
	Code R	Indicates 321 per AMS-QQ-S-763.
	Code S	Indicates 347 per AMS-QQ-S-763.
Carbon steel	Code -	Indicates 4130 per MIL-S-6758 or 4140 per MIL-S-5626.
Aluminum Alloy	Code D	Indicates 2024-T6 or T851 per QQ-A-225/6 for
		per QQ-A-367 for forging material.
	Code W	Indicates 7075-T73 per QQ-A-225/9 for bar/plate stock materials or per QQ-A-367 for forging material.

### MATERIAL AND CODING

#### **RECOMMENDATION OF PACKING AND LUBRICANT**

SYSTEM FLUID	PACKING	LUBRICANT
Hydraulic - Petroleum base	MS28778, MS3393 and/or MIL-R-83248/1 or /2	System fluid
Hydraulic - Phosphate base	NAS1612	System fluid
Pneumatic	MS9385	MIL-G-4343
Engine lubricant - Petroleum base Engine lubricant - Synthetic base Engine fuel - JP3, JP4, JP5, JP6, RJ1, RP1 or HEF2	MIL-R-83248/1 "	System fluid "
Oxygen	MS9385	None
Vacuum	MIL-R-83248/2	None
Coolant - Ethylene Glycol Coolant - Silicate Esters	MS28778	None "

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures: (Shape fittings are rated for 1500 psi on all sizes)

FIGUINO	TUDE	OPERATING PR	ESSURE (psi)
SIZE	O.D.	Ti Alloy & Cres	Alum Alloy
02	1/8	3000	3000
03	3/16	3000	3000
04	1/4	3000	3000
05	5/16	3000	3000
06	3/8	3000	3000
07	7/16	3000	3000
08	1/2	3000	3000
09	9/16	3000	3000
10	5/8	3000	3000
11	11/16	3000	3000
12	3/4	3000	3000
14	7/8	3000	3000
16	1	3000	1500
18	1-1/8	1500	1500
20	1-1/4	1500	1500
24	1 - 1/2	1500	1000
28	1-3/4	1500	600
32	2	1500	600

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.



Boss Fittings and Equivalent Ind	ustrv Standards
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							, ,	
	Reduc	er Port	Seque	nce for				
Fitting Shape	A ird	rom r Pa	art No.	only	Airdrome	Aerospace	Military	Airforce – Navy
	(See	Examp	le of P	art.)	Standard	Standard	Standard	Standard
	1	2	3	4				
Plug	**M				AP2507			
	М				AP7002	AS4350		
Straight	**M	F			AP770			
	F	М			AP 227	AS5172	MS24397	AN 893
	F	F			AP244	AS4349		
45 deg. Elbow	F	F			AP7393			A N 9 4 1
	F	М			AP7384			
90 deg. Elbow	F	F			AP7394			A N 939
	F	М			AP7347			
Tee	F	F	F		AP976			A N 938
	F	F	М		AP7600			
	F	М	F		AP7525			
Cross	F	F	F	F	AP7725			AN937
	F	F	F	М	AP7726			

Note: 1. F = Female port, M = Male port. 2. \*\* = Male port has integral metal seal.

## FLARED SEPARABLE FITTING



#### **DESIGN CONCEPT:**

The concept of Flared connection is to flare the tube end forming an internal 37 degree cone while supported by the AN818 nut and MS20819 sleeve behind the flared portion. It mates with a 37 degree fitting nose inserted into the flared tube end with external threads on the fitting to secure with the AN818 nut to maintain sealing.

When working with high strength tube materials or thick tube wall which makes it difficult to flare the tube end. The option of using a machined 37 degree single fitting cone or a double cone of a different design option will take place to mate with the conventional 37 degree fitting nose. The angle on the outer cone of  $38-\frac{1}{2}$  degree slightly larger than the 37 degree fitting nose is for alignment support and the 25 degree on the inner cone angle is for clearance purposes. The intersection of the two cone angles formed a sealing point landed on the mid section of the 37 degree fitting nose assures positive sealing. Thus, it eliminates undesirable sealing locations at extreme upper or lower edges of contacts between the 37 degree fitting nose and the single flared cone depending on the tolerance of  $37 + \frac{1}{2}$  degree on both mating angles. It also eliminates sensitive nut binding and leakage as a result from nut over torque.

Another design option is to use the Seal Ring concept on the conventional 37 degree fitting nose. Sealing takes place with the Teflon ring compressed against the mating 37 degree cone. The Seal Ring connection assures positive sealing under tolerable misalignment conditions.

Both design options offer high degree of sealing reliability for repeated usage. It is however not recommended using double cone and Seal Ring nose to mate with each other.

#### **DESIGN ADVANTAGES:**

- X Sealing efficiency eliminates down time and high repair cost.
- X Assembly of Flared connections can be made in place for production and repair applications.
- X Fittings are available in Cres, Titanium Alloy and Aluminum Alloy materials which are virtually compatible for use with just about any tube materials.
- **C** No special tooling is required except standard torque wrenches for fitting installation.

#### STANDARD PROCUREMENT SPECIFICATION FOR FLARED FITTINGS

SAE AS4841 or Military MIL-F-5509 specifications define Form, Fit, Function and Procurement requirements for Flared fittings.

#### **APPROVAL STATUS**

Airdrome fittings are approved for use in various military and commercial programs at Boeing, General Electric, Honeywell, Pratt & Whitney, Sikorsky, etc.

#### FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with varies tubing materials, fluid and operating temperature:

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928.
Cres	Code J	Indicates 304 per AMS-QQ-S-763.
	Code K	Indicates 316 per AMS-QQ-S-763.
	Code R	Indicates 321 per AMS-QQ-S-763.
	Code S	Indicates 347 per AMS-QQ-S-763.
Carbon steel	Code -	Indicates 4130 per MIL-S-6758 or 4140 per MIL-S-5626.
Aluminum Alloy	Code D	Indicates 2024-T6 or T851 per QQ-A-225/6 for bar/plate stock materials or 2014-T6 per qQ-A-367 for forging material.
	Code W	Indicates 7075-T73 per QQ-A-225/9 for bar/plate stock materials or per QQ-A-367 for forging material.

#### MATERIAL AND CODING

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING	TUBE	OPERATING PR PER FITTING N	ESSURE (psi) MATERIAL
SIZE	O.D.	Ti Alloy & Cres	Alum Alloy
02	1/8	3000	3000
03	3/16	3000	3000
04	1/4	3000	3000
05	5/16	3000	3000
06	3/8	3000	3000
08	1/2	3000	3000
10	5/8	3000	3000
12	3/4	3000	3000
16	1	3000	3000
20	1-1/4	1500	1500
24	1 - 1/2	1500	1500
28	1-3/4	1500	1500
32	2	1500	1500

## **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**





AP7711	AP230		AP7598			AP213		AP7129	1 - 2	AP241	1	AP50	#	
AP7720	AP7717	3 1	AP7566		1 2 3 AP251	 AP211		AP7348	1	AP7231	1 - 2	AP100	#	
AP7721	AP7718	1 ⊕ ⊕ 2 1 ⊕ ⊕ 4	AP7555		1 2 3 AP265	AP262		AP225	1	AP202/AP203	1 1 2	AP273	Ð	
AP7722	AP2656	3 1 1 2 2 4	AP235	1 ⊕ ⊕ 2	1 2 3 AP264	2 AP232		AP263	1	AP208	1 1 2	AP270		
AP7723	AP7719	1	↔ AP7518	1 2		2 AP258		AP233	1	AP207	1 2	AP271	1 🕀	
AP7724	AP863		Ф АР7599	1 1 2	1 2 3 AP234	3 AP217	1 ⊕⊕⊕ 2	AP259	1	AP231	1 1 2	AP272	1	

	Port S	Sequence	ce for						
Fitting Shape	Airdro	me Par	rt no. or	nly	Airdrome	Aerospace	National	Military	Airforce - Navy
	(See E	Example	e of Par	t No.)	Standard	Standard	Aerospace	Standard	Standard
	1	2	3	4			Standard		
Seal					AP50	AS3072			
						AS3074			
					AP100	AS4824			
Jam Nut					AP273	AS5178			AN924
Coupling Nut					AP270	AS4326			AN818
Sleeve	F				AP271	AS5176		MS20819	
Cap	F				AP272	AS4329			AN929
Plug	М				AP241	AS5168		MS24404	AN806
Straight	F	М			AP7231		NAS1564		
	Μ	М			AP202			MS24392	AN815
					*AP203			*MS24399	*AN919
	F	F			AP208	AS4406			
	F	М			AP207	AS4405			
	M	В			AP231	AS1037		MS24393	AN832
	F	В			AP7129				
45 deg. Elbow	M	М			AP7348				
	F	F			AP225				
	F	М			AP263	AS4409			
	M	В			AP233	AS1040		MS24396	AN837
	F	В			AP259				
90 deg. Elbow	Μ	М			AP213	AS1034		MS24401	AN821
	F	F			AP211	AS4408			
	F	М			AP262	AS4407			
	Μ	В			AP232	AS1038		MS24394	AN833
	F	В			AP258				
Tee	М	М	M		AP217	AS1035		MS24402	AN824
	F	F	F		AP240				
	F	F	M		AP251				
	М	М	F		AP265	AS4411			
	F	М	M		AP264	AS4410			
	M	F	F		AP222				
	М	В	M		AP234	AS1033		MS24390	AN804
	M	В	F		AP7598				
	F	В	M		AP7566				
	F	В	F		AP7555				
	M	M	В		AP235	AS1039		MS24395	AN834
		M	В		AP7518				
	F	F	В		AP7599				
Cross	M	M	M	M	AP230	AS1036		MS24403	AN827
		F	-	-	AP7717				
	M	M			AP7718				
	F	M		F	AP2656				
		M	F	M	AP//19	1005			
		M	M	M	AP863	AS95			
	B	M	M	M	AP7711				
	B	F	F	F	AP7720				
	В	M	⊢ •		AP/721				
	В		M	M	AP7722				
	В			M	AP7723		ļ		
	В	M	F	M	AP7724				

37 deg. Flared Fittings and Equivalent Industry Standards

Notes: 1. F = Female port, M = Male port, B = Bulkhead male port. 2. \* = A different part number assigned for reducers.



	Port S	equend	ce for				
Fitting Shape	Airdro	me Par	t No. o	nly	Airdrome	Aerospace	Military
0 1	(See E	xampl	e of Pa	rt No.)	Standard	Standard	Standard
	<u>`</u> 1	2	3	4			
Straight	M	**M			AP2501		
Ottaight					*AP2503		
	F	**\/			AP1105		-
	N/	N/			AP7104		
					AP7104		
	F	IVI			AP1051		1004045
	F				AP236		MS21915
	F	F			AP229		
	В	F			AP7232		
45 deg. Elbow	M	M			AP7357		
	F	М			AP7405		
	M	F			AP7406		
	F	F			AP7409		
	В	F			AP7407		
90 deg. Elbow	Μ	М			AP7319		
0	F	М			AP7346		
	F	М			AP7408		
	F	F			AP7410		
	F	B			AP2616		
Tee	M	M	М		AP7569		
166		M			AP7626		
	F M				AP7020		
					AP7627		
	F	IVI	IVI		AP7628		
	M	M	M		AP7568		
	F	F _	M		AP7629		
	M	F	M		AP7630		
	М	F	M		AP7631		
	F	F	F		AP7632		
	M	F	F		AP7633		
	F	F	Μ		AP7634		
	Μ	Μ	F		AP1053		
	F	F	F		AP7503		
	F	М	F		AP7528		
	F	F	М		AP7638		
	F	F	F		AP7639		
	М	F	М		AP7640		
	М	F	F		AP7641		
	F	M	F		AP7642		
	F	F	F		AP7643		-
	M	M	F		AP7644		
	M	E	F		AP7645		
	N/	F	Г		AP7640		
		F	IVI NA		AF / 040		
					AF/04/	A \$ 1004	MOMMA
	В				AP7635	A\$1001	WIS21910
		В			AP943		
	M		В		AP/66	10/222	1100101
	В	F	M		AP7511	AS1002	MS21911
	В	F	F		AP7636		
	F	F	В		AP7637		
	F	F	В		AP7515		
	В	F	F		AP7547		
Cross	М	М	М	М	AP7739		
	F	F	F	F	AP7740		
	Μ	Μ	Μ	Μ	AP7741		
	F	F	F	F	AP7742		
	F	М	М	М	AP7743		

Adapters for 24 deg. Flareless to Boss and Equivalent Industry Standards

 Notes:
 1. F = Female port, M = Male port, B = Bulkhead male port.

 2. \* = A different part number assigned for reducers.

 3. \*\* = Male Boss port has an integral metal seal.

ŧ		Ð	-			1-	⊨	1		1 - 1 2	
AP18000		AP27	'3		AP270	A	P271	AP272		AP18111	
1	1		₽ 2	1 -1	1 - C		2	' - E			
AP18104		AP181	10		AP18108	AP	18336	AP18333		AP18332	
	1			1 -		2 - <b>(</b> ]			<b>}</b> - 1-€	1- <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()</b> <b>()()()()()()()()()()</b>	
AP18335	_	AP183	331		AP18563	AP	18554	AP18555		AP18558	
18564	1 -		2 1 1 76	2							
		3	7 dea.	 Seal R	ling Flared	Fittings an	d Equivale	ent Industrv S	tandards		
		Port Se	equenc	e for	J		•				
Fitting Shape	Air (See	drome Examp	Part N le of P	o. only art No.)	Airdrome Standard	Aerospace Standard	Kennedy S Sta	Space Center andard	Military Standard	Airforce - Nav Standard	
Seal		2	3	4	AP18000	AS1097	K	C103			
Jam Nut					AP273	//01007		0100		AN924	
Coupling Nut		[			AP270	AS4326				AN818	
Sleeve	F				AP271	AS4327	K	C143	MS20819	)	
Сар	F				AP 272	AS4329				AN929	
Plug	М				AP18111	AS1369	K	C130			
Straight	F	М			AP18104	AS4301	K	C106			
	M	M			AP18110	AS1251	K	C126			
					40400	*AS1368	K	<u>C125</u>			
					AP 10108	ASITUU	K	0124			
45 dag Elbaw		R R			AF 10330	AS1240	n K	C128			
45 deg. Elbow	M				AP 18332	AS1250	K	C118			
45 deg. Elbow	M	М			7.1 1000L	AS4315	K	C131			
45 deg. Elbow 90 deg. Elbow	M M M	M F			AP 18335		· · · · ·	C113			
45 deg. Elbow 90 deg. Elbow	M M M M	M F B			AP 18335 AP 18331	AS1366	K	0110		1	
45 deg. Elbow 90 deg. Elbow Tee	M M M M M	M F B M	M		AP 18335 AP 18331 AP 18563	AS1366 AS1252	<u> </u>	C123			
45 deg. Elbow 90 deg. Elbow Tee	M M M M M M	M F B M F	M		AP 18335 AP 18331 AP 18563 AP 18554	AS1366 AS1252 AS4302	K K	C123 C107			
45 deg. Elbow 90 deg. Elbow Tee	M M M M M M M	M F M F M	M M F		AP 18335 AP 18331 AP 18563 AP 18554 AP 18555	AS1366 AS1252 AS4302 AS4304		C123 C107 C109			
45 deg. Elbow 90 deg. Elbow Tee	M M M M M M M M	M F M F M B	M M F M		AP 18335 AP 18331 AP 18563 AP 18554 AP 18555 AP 18558	AS1366 AS1252 AS4302 AS4304 AS1365		C123 C107 C109 C114			
45 deg. Elbow 90 deg. Elbow Tee	M M M M M M M M M	M F M F M B M	M M F M B		AP18335 AP18331 AP18563 AP18554 AP18555 AP18558 AP18564	AS1366 AS1252 AS4302 AS4304 AS1365 AS1253	K K K K	C123 C107 C109 C114 C127			

1 -	1	1 - 1 - 2 AP18113	1 - 2 AP18334	1	1 2 3 AP18556
1 2 	1 2 2 3 AP18559	1 1 1 1 1 1 1 1 1 1 2 2 3 3 AP18560			

	A	dapte	rs for 3	37 deg.	. Seal Ring	Flared to	Boss Fittings
			an	d Equi	valent Ind	ustry Stand	lards
		Port Se	equenc	e for			
Fitting Shape	Airc	lrome F	<sup>o</sup> art No	. only	Airdrome	Aerospace	Kennedy Space Center
	(See	Examp	le of pa	art No.)	Standard	Standard	Standard
	1	2	3	4			
Straight	М	М			AP 18105	AS4307	KC112
	F	М			AP 18106	AS4308	KC115
	М	В			AP 18113	AS4318	KC134
45 deg. Elbow	М	М			AP 18334	AS4314	KC129
90 deg. Elbow	М	М			AP 18330	AS4303	KC108
Tee	М	М	М		AP 18556	AS4305	KC110
	М	М	М		AP 18557	AS4306	KC111
	В	F	М		AP 18559	AS4310	KC119
	В	М	F		AP 18560	AS4311	KC120
Note: 1. F =	Female	e 37 de	g. Sea	l Ring I	Flared or Bo	oss ports,	
M =	Male	37 deg.	Seal I	Ring Fla	ared or Bos	s ports,	
B =	Bulkhe	ead 37	deg. S	eal Rin	g Flared ma	ale port.	

## FLARELESS SEPARABLE FITTING



#### **DESIGN CONCEPT:**

The concept of Flareless provides positive sealing and a high degree of sealing reliability for repeated usage. The configuration of Flareless joint consists an acorn shaped fitting nose designed to mate with a 24 degree cone fitting end forming a sealing point.

A gage diameter is provided on the acorn Flareless nose near the sealing diameter for installation reference and inspection purposes. The sealing point is located at the thicker wall area of both mating fitting ends to assure proper sealing with no plastic deformation through repeated usage.

A pilot end was added to the front nose of the acorn Flareless that fits inside the undercut of the 24 degree mating cone. This feature provides fitting alignment to effect positive sealing. In addition, a predetermined bottoming gap distance between mating fitting ends at the pilot nose and the shoulder is for preventing damage on the acorn Flareless nose by over torque on the nut.

Removal of the pilot end to make a shorter fitting is optional when fittings are used in tight areas or lighter weight is required. Either option is in use successfully in the industry.

Shape fittings such as elbow, tee or cross are available in a "Lightweight" version. It saves on an average of 30 % lighter weight than the Standard version.

#### **DESIGN ADVANTAGES:**

- X Sealing efficiency eliminates unnecessary down time and high repair cost.
- X Assembly of Flareless connections can be made in place for production and repair applications.
- X Design concept offers self-alignment to effect proper sealing. It offers bottoming feature to protect fitting from damage caused by nut over torque.

- X Fittings are available in Cres, Titanium Alloy and Aluminum Alloy materials which are virtually compatible for use with just about any tube materials.
- **C** No special tooling is required except standard torque wrenches for fitting installation.

# STANDARD PROCUREMENT SPECIFICATIONS FOR FLARELESS FITTINGS

SAE AS18280 or Military MIL-F-18280 specifications define Form, Fit, Function and Procurement requirements for Flareless fittings.

## **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per AS/MIL-F-18280 and are reflected per PRI-QPL-AS18280. The same fittings were subjected to further testing for broader applications and the approval status is reflected per Boeing BPS-F-125 specification.

The fittings are approved for use in various military and commercial programs at Boeing, Bombardier, Canadair, Cessna, DeHavilland etc.

## FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with various tubing materials, fluid and operating temperature:

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928.
Cres	Code J	Indicates 304 per AMS-QQ-S-763.
	Code K	Indicates 316 per AMS-QQ-S-763.
	Code R	Indicates 321 per AMS-QQ-S-763.
	Code S	Indicates 347 per AMS-QQ-S-763.
	Code V	Indicates 15-5PH, H-1075 cond., per AMS5659.
Carbon Steel	Code -	Indicates 4130 per MIL-S-6758 or 4140 per MIL-S-5626.
Aluminum Alloy	Code D	Indicates 2024-T6 or T851 per QQ-A-225/6 for bar/plate stock materials or 2014-T6 per QQ-A-367 for forging fittings.
	Code W	Indicates 7075-T73 per QQ-A-225/9 for bar/plate stock materials or per QQ-A-367 for forging material.

#### MATERIAL AND CODING

## SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING	TUBE	OPERAT PER FIJ	OPERATING PRESSURE (psi) PER FITTING MATERIAL					
SIZE	O.D.	Ti Alloy	Cres	Alum Alloy				
03	3/16	4000	3000	3000				
04	1/4	4000	3000	3000				
05	5/16	4000	3000	3000				
06	3/8	4000	3000	3000				
08	1/2	4000	3000	3000				
10	5/8	4000	3000	3000				
12	3/4	4000	3000	3000				
14	7/8	4000	3000	3000				
16	1	4000	3000	1500				
20	1-1/4	1500	1500	1500				
24	1-1/2	1500	1500	1000				

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTING**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.



	Po	ort Seq	uence	for			
Fitting Shape	Airdr	ome P	art No.	only	Airdrome	Aerospace	Airforce - Navy
	(See E	xample	e of Pa	rt No.)	Standard	Standard	Standard
	1	2	3	4			
Seal					AP7035		
Jam Nut					AP273	AS5178	AN924
Coupling Nut					AP1034	AS1792	
Sleeve	F				AP7018		
Сар	F				AP7045		
Plug	М				AP1016		
45 deg. Elbow	М	М			AP3224		
°,	F	F			AP3233		
	F	М			AP1041	AS4137	
	В	М			AP2854	AS4130	
	F	В			AP3232		
90 deg. Elbow	М	М			AP2851	AS4131	
<u>-</u>	F	F			AP3225		
	F	М			AP1042	AS4138	
	B	M			AP2853	AS4132	
	В	F			AP3226		
Tee	М	М	М		AP2852	AS4133	
100	F	F	F		AP3246	7101100	
	F	F	M		AP3254		
	M	M	F		AP1040	AS4140	
	F	M	M		AP1039	AS4139	
	M	F	F		AP3247		
	B	M	M		AP2855	AS4134	
	B	M	F		AP3255		
	B	F	M		AP3256		
	B	F	F		AP3257		
	M	M	B		AP2856	AS4135	
	F	M	B		AP3258	7101100	
	F	F	B		AP3259		
Cross	М	М	M	М	AP3262	AS4136	
0.000	F	F	F	F	AP3266	7.01100	
	M	M	F	F	AP3276		
	F	M	F	F	AP3268		
	F	M	F	M	AP3269		
	M	M	M	F	AP3270	AS4141	
	M	B	M	M	AP3271		
	F	B	F	F	AP3272		
	M	B	F	F	AP3273		
	F	B	M	M	AP3274		
	F	B	F	M	ΔΡ3275		
	M	B	F	M	ΔP3276		
	111	ט		171			

#### Lightweight 24 deg. Flareless Fittings and Equivalent Industry Standards

Note: 1. F = Female port, M = Male port, B = Bulkhead male port.



Fitting Shape					Airdrome	Aerospace	National	Military	Airforce - Navy
	1	2	2	4	Standard	Standard	Aerospace	Standard	Standard
Sool		2	3	4	AD7025	101005	Standard		
Jom Nut					AF7033 AD272	A34023			ANI024
Coupling Nut					AP213	485234		MS21021	AN924
Sleeve	F				ΔP7018	AS5234		MS21921	
Press Can	F				AP1008	AS5233		MS21914	
Dust Cap	F				74 1000	AS4300		WICE TO TH	
Plua	M				AP1016	AS5231		MS21913	
Straight	М	М			AP1001	AS5230		MS21902	
5 <u>5</u>					*AP1027			*MS21916	
	F	F			AP7112				
	F	М			AP1059				
	В	М			AP1002	AS1007		MS21924	
	В	F			AP7230				
45 deg. Elbow	М	М			AP7365				
	F	F			AP7396				
	F	М			AP1009		NAS1761		
	М	В			AP7310	AS1010		MS21907	
	F	В			AP7397				
90 deg. Elbow	М	М			AP1056	AS1004		MS21904	
	F	F			AP7301				
	F	М			AP1010		NAS1762		
	М	В			AP7311	AS1008		MS21908	
	F	В			AP7398				
Tee	M	M	M		AP7572	AS1005		MS21905	
	F	F	F		AP7501				
	F	+	M		AP1073				
	M	M	<u>+</u>		AP1015		NAS1764		
		M	<u>M</u>		AP1013		NAS1763		
		M			AP1074	A \$ 4000		MC04040	
		В			AP7551	AS1003		INIS21912	
					AP707				
		D			AF760				
	M	M	R I		AP7573	A\$1009		MS21000	
	F	M	B		AP7602	701003		10021303	
	F	F	B		AP7603				
Cross	M	M	M	М	AP7727	AS1006		MS21906	
01000	F	F	F	F	AP7701	7101000		111021000	
	M	M	F	F	AP7728				
	М	F	F	F	AP7702				
	F	М	F	М	AP7729				
	М	М	Μ	F	AP1011				
	М	М	М	В	AP1050				
	F	В	F	F	AP7730				
	М	В	F	F	AP7731				
	F	В	М	Μ	AP7732				
	F	В	F	M	AP7733				
	М	В	F	M	AP7734				

24 deg. Flareless Fittings and Equivalent Industry Standards

Notes: 1. F = Female port, M = Male port, B = Bulkhead male port. 2. \* = A different part number assigned for reducers.



	Port S	equend	ce for				
Fitting Shape	Airdro	me Par	t No. o	nly	Airdrome	Aerospace	Military
· ·	(See E	xampl	e of Pa	rt No.)	Standard	Standard	Standard
	<u> </u>	2	3	4			
Straight	М	**M	-		AP2501		
otraight					*AP2503		
	F	**N/			AP1105		
	N/	N/			AP7104		
					AP7104		
	F	IVI			AP1051		11004045
	F	M			AP236		MS21915
	F	F			AP229		
	В	F			AP7232		
45 deg. Elbow	М	М			AP7357		
	F	Μ			AP7405		
	М	F			AP7406		
	F	F			AP7409		
	В	F			AP7407		
90 deg. Elbow	М	М			AP7319		
ee dog. Elbon	F	M			AP7346		
	- F	M			A D7409		
					AP7400		
					AP7410		
	F	в			AP2616		
Тее	M	M	M		AP7569		
	F	M	F		AP7626		
	М	М	F		AP7627		
	F	М	М		AP7628		
	М	М	М		AP7568		
	F	F	М		AP7629		
	М	F	М		AP7630		
	М	F	М		AP7631		
	F	F	F		AP7632		-
	M	F	F		AP7633		
	F	F	M		AP7634		
	N/	N/			AP1054		
			Г		AF 1033		
	F	F	F		AP7503		
	F	M	F		AP7528		
	F	F	M		AP7638		
	F	F	F		AP7639		
	M	F	M		AP7640		
	Μ	F	F		AP7641		
	F	М	F		AP7642		
	F	F	F		AP7643		
	М	М	F		AP7644		
	М	F	F		AP7645		
	М	F	М		AP7646		
	F	F	M		AP7647		
	B	M	F		AP7635	A\$1001	MS21010
			- -		AP042	A31001	101321910
			r P		AF 943		
			D MA		AP700	A 0 4 0 0 0	MODADAA
	В		M		AP/511	AS1002	MS21911
	В	F	F		AP7636		
	F	F	В		AP7637		
	F	F	В		AP7515		
	В	F	F		AP7547		
Cross	М	М	М	М	AP7739		
	F	F	F	F	AP7740		
	М	М	М	Μ	AP7741		
	F	F	F	F	AP7742		
	F	M	M	M	AP7743		
		141	141	171	AI 1143		

Adapters for 24 deg. Flareless to Boss and Equivalent Industry Standards

 Notes:
 1. F = Female port, M = Male port, B = Bulkhead male port.

 2. \* = A different part number assigned for reducers.

 3. \*\* = Male Boss port has an integral metal seal.



	P	ort Seq	uence f	or			
Fitting Shape	Aird	rome P	art No.	only	Airdrome	Aerospace	Military
	(See E	Example	e of Par	t No.)	Standard	Standard	Standard
	1	2	3	4			
Straight	М	М			AP981	AS5238	MS21900
							MS24405
	F	Μ			AP7138		
	Μ	F			AP7114		
	F	F			AP7106		
	Μ	В			AP7233		MS21923
	Μ	В			AP7111		
	F	В			AP7145		
	F	В			AP7234		
45 deg. Elbow	Μ	Μ			AP7411		
	F	В			AP7412		
	F	Μ			AP7413		
	F	F			AP7414		
	M	В			AP7424		MS24654
	F	В			AP7415		
	Μ	В			AP7308		
	F	В			AP7416		
90 deg. Elbow	Μ	Μ			AP7387		
	F	М			AP7417		
	F	Μ			AP7419		
	F	F			AP7420		
	Μ	В			AP7418		MS24651
	F	В			AP7421		
	Μ	В			AP7422		MS24652
	F	В			AP7423		
Tee	М	М	М		AP7648		
	Μ	М	F		AP7649		
	Μ	F	F		AP7650		
	Μ	F	М		AP7651		
	Μ	F	М		AP7656		
	F	Μ	F		AP7657		
	F	F	F		AP7658		
	F	F	М		AP7659		
	Μ	Μ	М		AP7667		
	F	F	М		AP7668		
	Μ	F	М		AP7669		
	Μ	Μ	F		AP7672		
	F	F	F		AP7673		
	Μ	F	F		AP7674		
	F	Μ	М		AP7596		
	Μ	Μ	М		AP7680		
	Μ	F	F		AP7681		
	F	F	F		AP7682		
	М	Μ	F		AP7684		
	Μ	F	F		AP7685		
	F	Μ	М		AP7687		
	F	F	М		AP7688		
	М	М	М		AP7565		
	М	М	F		AP7698		
	F	F	М		AP7699		
	F	F	F		AP7036		
	F	М	М		AP7038		
	М	F	F		AP7039		
	F	В	М		AP7660		
	Μ	В	М		AP7514		

Adapters for 24 deg. Flareless to 37 deg. Flared Fittings

Note: 1. F = Female port, M = Male port, B = Bulkhead port.



							<b>j</b> -
	P	ort Seq	uence f	or			
Fitting Shape	Aird	rome P	art No.	only	Airdrome	Aerospace	Military
<b>°</b> '	(See E	Example	e of Par	t No.)	Standard	Standard	Standard
	1	2	3	4			
Tee		2	5	-			
l ee	IVI	В	F		AP7654		
	F	В	F		AP7661		
	F	В	M		AP7671		
	Μ	В	F		AP7675		
	F	В	F		AP7676		
	М	В	М		AP7509		
	F	В	F		AP7683		
	M	B	M		AP7686		
		D	M		A D7690		
	M	D			AP7609		
	IVI	D			AP7513		
	M	В	F		AP7664		
	F	В	F		AP7665		
	F	В	M		AP7666		
	Μ	В	M		AP7670		
	F	В	М		AP7692		
	М	В	F		AP7695		
	F	B	F		AP7696		
		D	N/		AP7607		
	M	D			AF7097		
	IVI	В			AP7041		
	M	В	F		AP7042		
	F	В	M		AP7043		
	F	В	F		AP7044		
	Μ	Μ	В		AP7653		
	М	F	В		AP7662		
	F	F	В		AP7678		
	F	F	B		AP7694		
	M	M	B		AP781		
	M	F	B		AP7040		
			D		AF 7040		
		Г	D		AP7000		
	F	F	В		AP7663		
	M	M	В		AP7677		
	M	F	В		AP7679		
	Μ	Μ	В		AP7690		
	Μ	F	В		AP7691		
	М	F	В		AP7693		
	F	F	В		AP7037		
Cross	M	M	M	М	ΔΡ7744		
01033	IVI NA	IVI NA	IVI NA	IVI NA	AD7745		
		IVI	IVI		AF1140		
	IVI	IVI	IVI	IVI	AP//46		
	M	M	M	M	AP7747		
	F	F	F	F	AP7748		
	F	F	F	F	AP7749		
	F	F	F	F	AP7750		
	F	F	F	F	AP7751		
	M	В	М	М	AP7752	İ	
	M	B	M	F	AP7753		
	N/	P	N/	N4	AD775/		
	N/	D	N/	N/	AD7755		
	IVI	В	IVI	IVI	AP//55		
	M	В	M	M	AP7756		
	М	В	M	M	AP7757		
	Μ	В	Μ	F	AP7758		
	M	В	Μ	M	AP7759		
	М	В	Μ	Μ	AP7760		
	М	В	Μ	Μ	AP7761		

Adapters for 24 deg. Flareless to 37 deg. Flared Fittings

Note: 1. F = Female port, M = Male port, B = Bulkhead male port.

#### DUAL/SEAL SEPARABLE FITTING



#### DESIGN CONCEPT

DualISeal is a registered trademark of a Dynamic Beam Seal fitting offers unique double sealing. The design of DualISeal fitting end has a circumferential beam with a wavy cross sectional profile. The elegant geometric of the beam will uniformly deflect against the mating fitting end creating two circular points of sealing.

At the beginning of nut torque, the primary seal is formed at the lower tangent point of the seal beam. Continuing to tighten the nut will form a secondary seal at the upper tangent point of the seal beam. The secondary seal provides another function as a stop (bottoming) preventing nut over torque to damaging the primary seal for repeated usage. The bottoming feature also provides stability of primary sealing at every DualISeal joints under vibration or bending conditions which are all critical requirements for flight conditions.

High strength materials are used for DualISeal fittings to achieve spring action for sealing force. When the seal beam is under deflection, the spring back force of the seal beam pushing on the mating fitting end creates a locking device for thread engagement. Upon disassembly, the elastic beam will spring back and will be ready for use again.

The contact surfaces (ie: mating fitting end and nut threads) are finished with dry film lubricant to assure ease of multiple repeated assemblies. As an option, dry film lubricant on mating fitting end can be exchanged for a bare metal surface with 8 micro smoothness for use in clean systems related to space programs.

#### **DESIGN ADVANTAGES:**

- A flush sealing face offers easy in place installation.
- Stronger material strength, smaller envelops and significantly lighter weight than Flared or Flareless (including Lightweight) fittings.
- Sealing efficiency eliminates unnecessary down time and high repair cost.
- Navy test results showed fatigue life up to 150% higher than Flared or Flareless fittings.
- Seals at lower nut torque than Boss, Flared or Flareless fittings.
- Threads per MIL-S-8879 or AS8879 of different pitches and diameters to avoid cross threading to Flared or Flareless fittings and nuts.
- X Fittings are available in Cres and Titanium Alloy materials that are virtually compatible for use with just about any high strength tube materials.
- **C** No special tooling is required except standard torque wrenches for fitting installation.

#### STANDARD PROCUREMENT SPECIFICATIONS FOR DUAL/SEAL FITTINGS

Military MIL-F-85421 and MIL-F-85720 specifications define Form, Fit, Function and Procurement requirements for DualISeal fittings.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per Military MIL-F-85421 and MIL-F-85720, Boeing 27M102 & 27M107, Northrop / Grumman 37A050 and Rockwell TFD-82-272 specifications.

The fittings are approved for use in various space, military and commercial programs at AIDC, Allison, Bell, Boeing Defense & Space Group, General Electric, Honeywell, Lockheed Martin, Northrop/Grumman, Rockwell, Sikorsky, Sunstran, etc.

#### FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with various tubing materials, fluid and operating temperature:

#### MATERIAL AND CODING

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4965.
Cres	Code N Code P Code -	Indicates Inconel 718 per AMS5663. Indicates 17-4PH, H-1075 cond., per AMS5643. Indicates 21-6-9 per AMS5656.

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING	TUBE	OPERATING PRESSURE (psi) PER FITTING MATERIAL				
SIZE	O.D.	Ti Alloy	Cres			
 03	3/16	8000	3000	-		
04	1/4	8000	3000			
05	5/16	8000	3000			
06	3/8	8000	3000			
07	7/16	8000	3000			
08	1/2	8000	3000			
09	9/16	5000	3000			
10	5/8	5000	3000			
11	11/16	5000	3000			
12	3/4	5000	3000			
13	13/16	5000	3000			
14	7/8	5000	3000			
15	15/16	5000	3000			
16	1	5000	3000			
21	1-1/4	4000	3000			
25	1-1/2	2000	2000			

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**





			nys an	iu Lyui		istry Stanua	Miller
	Port Sequence for				A		Military
Fitting Shape	Airdrome Part No. only			Airdrome	Aerospace	Specification	
	(See example of part no.)			Standard	Standard	Standard	
	1	2	3	4			
Seal					AP2641		
Jam Nut					AP391	AS5019	
Coupling Nut					AP184		
Press Cap	F				AP392	AS4214	
Dust Cap	F				AP396	AS4282	
Press Plua	М				AP390	AS4213	
Dust Plug	М				AP394		
Straight	М	М			AP300	AS4222	M85421/11
e i a g i i						*AS4212	
	F	F			AP319		
	M	F			AP356		
	101				*AP318		
	R	N/				∆ <i>⊆</i> /222	<u> </u> ]
						704220	
					AF 304	A C 4 E 4 4	M05404/40
45 deg. EIDOW					AP320	AS4541	IVI85421/12
		F			AP6761		
	F	M			AP339		M85421/14
	B	M			AP321	AS4220	M85421/15
	F	В			AP6778		
90 deg. Elbow	Μ	M			AP340	AS4542	
	F	F			AP348		
	F	Μ			AP358		
	В	М			AP341	AS4221	M85421/13
	F	В			AP357		
Tee	Μ	М	М		AP360	AS4210	M85421/3
	F	F	F		AP375	-	
	F	F	М		AP370		
	М	М	F		AP379	AS4224	M85421/4
	M	F	M		AP378	AS4809	M85421/5
	M	F	F		AP376	,	11100 12 1/0
	R	М	М		AP362		M85421/16
	R	M	F		AP368		10100-72 1/ 10
	R	F	N/		AP6852		
	P				AD6959		
	M	N/	P		AD261		M85/01/17
			P		AP301		1000421/17
			D P		AF 300		
<u> </u>				N.4	AF00/9	104044	<b> </b>
Cross		M	M		AP380	AS4211	ļ]
					AP6919		]
	M	M	F	F	AP351		ļ
	Μ	F	F	F	AP382		
	M	F	F	M	AP6913	<u> </u>	
	F	Μ	М	Μ	AP324		
	В	Μ	М	Μ	AP6907		
	F	F	F	В	AP6914		
	F	F	М	В	AP6915		
	Μ	М	F	В	AP6916		
	Μ	F	F	В	AP6917		
	М	F	М	В	AP6918		
							A

**Dual Seal Fittings and Equivalent Industry Standards** 

Notes: 1. F = Female port, M = Male port & B = Bulkhead male port. 2. \* = A different part number assigned for reducers.



Adapters for Dual Seal to Boss Fittings											
	Po	rt Sequ	ence fo	or							
Fitting Shape	Air	drome	Part No	).	Airdrome						
· ·	(See E	xample	Standard								
	1	2	3	4							
Straight	М	**M	-		AP393						
orrangin	F	**M			AP2540						
	M	M			AP6613						
		M			AP6666						
		IVI			AF0000						
	F				AP336						
	F	F			AP560						
	В	F			AP6159						
	В	M			AP307						
45 deg. Elbow	М	M			AP6701						
	F	M			AP6779						
	М	F			AP6700						
	F	F			AP6780						
	В	F			AP6781						
90 deg. Elbow	М	Μ			AP649						
<b>U</b>	F	М			AP6707						
	F	M			AP6782						
	F	F			AP6783						
	F	B			AP6784						
Τοο	N4	M	N/								
Tee		IVI			AF031						
	Г		г г		AP664						
	IVI	IVI	F		AP6880						
	F	M	M		AP6881						
	M	M	M		AP653						
	F	F	М		AP6882						
	M	F	M		AP655						
	М	F	Μ		AP6883						
	F	F	F		AP472						
	М	F	F		AP6876						
	F	F	Μ		AP6819						
	М	Μ	F		AP363						
					*AP372						
	F	F	F		AP6868						
	F	M	F		AP6884						
	F	F	M		AP6885						
	F	F	F								
	N4		N4		A D6007						
					AF000/						
					APOSSS						
					AP0889						
					AP68//						
	M	M	F		AP654						
	M	F	F		AP6890						
	M	F	M		AP655						
	F	F	Μ		AP6892						
	В	Μ	F		AP6853						
	В	F	F		AP6893						
	В	F	Μ		AP6895						
	В	F	F		AP6896						
	F	В	F		AP6899						
	М	F	В		AP6894						
	F	F	B		AP6897						
	F	F	B		AP6898						
Cross	Ē		M	F	AD670						
01055		IVI NA	IVI N4		AF0/U						
					AF0920						
					AP6921						
	F	⊢ ⊢	F	F	AP6922						

Notes: 1. F = Female Dual Seal or Boss ports,

M = Male Dual Seal or Boss ports,

B = Bulkhead Dual Seal male port.

2. \* = A different part number assigned for reduvers.
3. \*\* = Male Boss port has integral metal seal.


	D	ort Sog	uonoo f	or.	J
Litting Change			A inclusions of		
Fitting Shape	AI	rarome	Part N	0.	Airdrome
	(See Example of Part No.)			Standard	
	1	2	3	4	
Straight	M	M			AP305
	F	М			AP310
	М	F			AP355
		-			*AP353
	F	F			AP316
	P	M			A B 200
	Б				AF 309
	F	В			AP6022
	M	В			AP306
	В	F			AP6023
45 deg. Elbow	Μ	Μ			AP6220
	F	Μ			AP6221
	F	М			AP6222
	F	F			AP6223
	B	M			ΔP327
	5	D			A D6624
					AP0024
	В	IVI F			AP325
	F	В			AP6225
90 deg. Elbow	Μ	Μ			AP566
	F	Μ			AP6749
	Μ	F			AP6703
	F	F			AP6750
	M	B			AP347
	F	B			AD6227
	N/				AF 0227
		В			AP474
	F	В			AP6226
Tee	M	Μ	M		AP6024
	М	Μ	F		AP6025
	Μ	F	F		AP6026
	F	Μ	М		AP6839
	F	М	М		AP323
	F	М	F		AP6027
	F	F	F		AP6028
	-	F	M		A P366
	N/	NA	NA		AP300
					AP 304
	F	F	IVI		AP6030
	M	F	M		AP6031
	M	M	F		AP6032
	F	F	F		AP6033
	Μ	F	F		AP6034
	Μ	F	М		AP681
	Μ	М	М		AP6050
	M	F	F		AP6051
	F	F	F		AP6052
	M	M	F		A D6052
			r r		AF0000
					AP6054
	F	M	M		AP6055
	F	F	М		AP6056
	Μ	Μ	М		AP6057
	Μ	Μ	F		AP682
	F	F	М		AP6058
	F	F	F		AP6059
	Ē	M	M		AP6060
			F		AP6061
	F	B	M		AP6035
4	N/	R	M		AP6036

Adapters for Dual Seal to 37 deg. Flared Fittings

 Notes:
 1. F = Female Dual Seal or 37 deg. Flared ports,

 M = Male Dual Seal or 37 deg. Flared ports,

 B = Bulkhead Dual Seal or 37 deg. Flared male ports.

 2. \* = A different part number assigned for reducers.

	Port Sequence for				Ĭ
Fitting Shape	Air	rdrome	Part No	0.	Airdrome
- ·	(See E	Example	e of Par	rt No.)	Standard
	1	2	3	4	
Straight	М	М			AP303
ettaight	F	M			AP315
	M	F			AP6664
	F	F			AP6665
	B	M			AP308
	F	B			AP6083
	M	B			AP6084
		B			AP6085
45 dog Elbow	N/	M			AD6000
45 deg. Elbow		IVI			AP6228
	F	IVI			AP6230
		IVI			AP6231
	F	F			AP6232
	В	M			AP6233
	F	В			AP6234
	В	M			AP6235
	F	В			AP6236
90 deg. Elbow	М	M			AP567
	F	M			AP6237
	M	F			AP6238
	F	F			AP6239
	М	В			AP6240
	F	В			AP6241
	Μ	В			AP6242
	F	В			AP6243
Tee	М	Μ	Μ		AP6331
	М	Μ	F		AP6332
	М	F	F		AP6333
	F	М	М		AP6334
	М	F	М		AP6335
	F	М	F		AP6336
	F	F	F		AP6337
	F	F	M		AP6338
	M	M	M		AP6339
	F	F	M		AP6340
	M	F	M		AP6341
	M	M	F		AP6342
	F	F	F		AP6343
	M	F	F		AP6811
	F	M	M		AP6360
	M	M	M		AP6361
	M	F	F		AP6362
	F	F	F		AP6363
	M	M	F		AP636/
	M	F	F		AP6365
		M	M		AD6366
			IVI NA		AF 0300
			IVI NA		AF030/
		IVI			AP0308
					AP6369
			M		AP6370
					AP6371
		M	M		AP6372
	M				AP6373
	F	B	M		AP6344
	М	В	М		AP6345

#### Adapters for Dual Seal to 24 deg. Flareless Fittings

 Note:
 1. F = Female Dual Seal or 24 deg. Flareless ports,

 M = Male Dual Seal or 24 deg. Flareless ports,

 B = Bulkhead Dual Seal or 24 deg. Flareless male ports.

	Po				
Fitting Shape	Ai	Airdrome Part No.		Airdrome	
	(See E	Exampl	e of Par	t No.)	Standard
	1	2	3	4	
Tee	Μ	В	F		AP6038
	Μ	В	F		AP6048
	М	В	М		AP6065
	F	В	F		AP6066
	M	B	F		AP6067
	M	B	M		AP6071
	F	B	M		AP6076
	F	B	F		AP6029
	- <u>-</u>	D			AP6040
	M		M		AP6040
					AP6042
		В	F		AP6043
	F	В	F		AP6044
	F	В	M		AP6045
	M	В	M		AP6046
	F	B	M		AP6047
	F	В	F		AP6049
	F	В	М		AP6068
	M	В	F		AP6074
	F	В	F		AP6075
	Μ	В	М		AP6080
	Μ	В	F		AP6081
	F	В	М		AP6082
	Μ	М	В		AP6037
	Μ	F	В		AP365
	F	F	В		AP6063
	F	F	В		AP6073
	Μ	Μ	В		AP6077
	М	F	В		AP6079
	М	F	В		AP6039
	F	F	В		AP6041
	M	M	B		AP6062
	M	F	B		AP6064
	M	M	B		AP6069
	M		B		AP6070
	M	- F	B		AP6072
			B		AP6072
0		1	D M	N.4	AP 0070
Cross		IVI	IVI	IVI	AP6943
	IVI	IVI	IVI	IVI	AP6944
	IVI	IVI	IVI	IVI	AP6945
	M	M	M	M	AP6946
	M	F	M	M	AP6947
	M	M	M	F	AP6948
	M	M	M	F	AP6949
	М	M	F	F	AP6950
	М	F	М	M	AP6951
	Μ	F	M	Μ	AP6952
	М	F	М	F	AP6953
	М	F	М	Μ	AP6954
	Μ	F	М	F	AP6955
	М	М	М	F	AP6956
	Μ	В	М	Μ	AP6957
	F	В	М	Μ	AP6958
	Μ	В	М	Μ	AP6959
	F	В	М	М	AP6960
		-			

Adapters for Dual Seal to 37 deg. Flared Fittings

 Notes:
 1. F = Female Dual Seal or 37 deg. Flared ports,

 M = Male Dual Seal or 37 deg. Flared ports,

 B = Bulkhead Dual Seal or 37 deg. Flared male ports.

2. \* = A different part number assigned for reducers.







		l l l l l l l l l l l l l l l l l l l			
	PO	n Sequ	A		
Fitting Shape	Air	drome	Part No	Э.	Airdrome
	(See E	xample	e of Par	t No.)	Standard
	1	2	3	4	
Tee	М	B	F		AP6347
100		B	M		AP6257
	Г	D			AP0337
	IVI	В	F		AP6358
	М	В	М		AP6377
	F	В	F		AP6378
	Μ	В	F		AP6379
	М	В	М		AP6383
	F	В	М		AP6387
	F	B	F		AP6304
					AD6254
	<u>г</u>				AP6354
	F	В	F		AP6350
	М	В	М		AP6352
	Μ	В	F		AP6353
	F	В	М		AP6355
	М	В	М		AP6356
	F	B	F		AP6350
	F	P	N 4		VD6300
		В			AP0300
	M	В			AP6386
	В	F	F		AP6859
	Μ	В	М		AP6391
	Μ	В	F		AP6392
	F	В	М		AP6393
	M	M	B		AP6346
	M		D		AD6240
		r F	D		AP0349
	F	F	В		AP6375
	F	F	В		AP6385
	Μ	М	В		AP6388
	Μ	F	В		AP6390
	Μ	F	В		AP6384
	М	F	В		AP6348
	F	F	B		AP6351
	М	М	B		AP6374
			D		AF0374
	IVI	F	В		AP6376
	M	M	В		AP6381
	М	F	В		AP6382
	F	F	В		AP6389
Cross	Μ	М	М	М	AP6962
	Μ	М	М	М	AP6963
	M	M	M	M	AP6964
	N/	N/	N/	M	A D6065
					AF 0900
	IVI		IVI		AP0900
	M	M	M	F	AP6967
	М	М	М	F	AP6968
	М	М	F	F	AP6969
	Μ	F	М	Μ	AP6970
	М	F	М	М	AP6971
	M	F	F	M	AP6972
	N/	F	N.4	N/	AD6072
		r F			AF09/3
	IVI	F	F	IVI	AP6974
	M	M	M	F	AP6975
	В	M	M	M	AP6976
	В	F	М	М	AP6977
	В	М	М	М	AP6978
	B	F	M	M	AP6979

Adapters for Dual/Seal to 24 deg. Flareless Fittings

 B
 F
 M
 M
 AP6979

 Note
 1. F = Female Dual Seal or 24 deg. Flareless ports, M = Male Dual Seal or 24 deg. Flareless ports, B = Bulkhead Dual Seal or 24 deg. Flareless male ports.

### **ORBITAL WELD PERMANENT FITTING**



#### **DESIGN CONCEPT:**

Weld fitting design offers smallest envelope, lightest weight and strongest joint among all other mechanical fitting joints. Navy test results showed an average welded joint has a durable fatigue life up to 150% higher than mechanically attached fitting joints. No wonder this concept is widely used in commercial and military programs worldwide.

The weld fitting end design has the simplest geometrical contour with an integral T-ring. It provides alignment for the fitting and tubing and is also a filler material for welding.

Fitting and tubing ends shall be cleaned prior to welding; one of the simplest cleaning methods is to spray acetone to the joint and it will quickly evaporate.

Weld fittings are easily to be welded by Orbital weld tooling with electronic memories to reproduce accurate repeated weld each time. It minimizes X-ray inspection to a large degree. Different tooling is available for bench production weld or portable welding. The unified welded joint provides a positive fluid sealing.

#### **DESIGN ADVANTAGES:**

- Unified weld joint offers positive sealing.
- Offers smallest envelope, lightest weight and strongest fitting joint.
- Electronic memories produce accurate repeated weld each time.
- Weld tooling requires lowest maintenance cost by replacing tungsten only.
- Integral T-ring offers self-alignment for fitting and tubing butting to support proper welding.

# STANDARD PROCUREMENT SPECIFICATIONS FOR ORBITAL WELD FITTINGS

SAE AS1576 and/or AS4459 specifications define Form, Fit, Function and Procurement requirements for Orbital Tube Weld fittings.

# **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were tested per SAE AS1576 and AS4459, Boeing 27M107 and BPS-F-125, Lockheed 5PTV5401 and Northrop 37A050 specifications.

The fittings are approved for use in various space, military, and commercial programs at Allison, Bell, Boeing, Commercial/Defense/Space Group, General Electric, Honeywell, Lockheed, Northrop/Grumman, Sikorsky, etc.

# TOOLING

Various welding equipment manufacturers offer Orbital Weld tooling and training.

# FITTING MATERIAL SELECTION

The Adapters or Permanent Orbital Tube Weld fittings are offered in the following applicable materials for use with various tubing materials, fluid, and operating temperature:

#### MATERIAL AND CODING

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928 (all except Dual∫Seal parts) and AMS4965 (for Dual∫Seal parts only).
Cres	Code J	Indicates 304 per AMS-QQ-S-763 (all except Dual Seal parts).
	Code N Code R	Indicates Inconel 718 per AMS5663.
	Code R	Indicates 17-4PH, H-1075 cond. per AMS5045. Indicates 321 per AMS-QQ-S-763 (all except Dual∫Seal parts).
	Code S Code V	Indicates 34 / per AMS-QQ-S-763 (all except Dual/Seal parts). Indicates 15-5PH, H-1075 cond., per AMS5659.
	Code JL Code KL	Indicates 304L per AMS-QQ-S-763 (all except Dual/Seal parts). Indicates 316L per AMS-QQ-S-763 (all except Dual/Seal parts).
	Code -	Indicates 21-6-9 per AMS5656.
Aluminum Alloy	Code D	Indicates 6061-T6 per QQ-A-225/8 (all except Dual∫Seal parts)

# SIZE, MATERIAL, AND TUBE WALL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

		OPERA	TING PF	RESSURE (psi	) PER FITTING N	ER FITTING MATERIAL	
FITTING	TUBE	FLARE	ED & FLA	RELESS	DUAL SEAL SEPARABLE		
SIZE	O.D.	SEPARAB	LE WEL	D FITTINGS	WELD FI	TTINGS	
		Ti Alloy	Cres	Alum Alloy	Ti Alloy	Cres	
03	3/16	4000	3000	1500	8000	3000	
04	1/4	4000	3000	1500	8000	3000	
05	5/16	4000	3000	1500	8000	3000	
06	3/8	4000	3000	1500	8000	3000	
07	7/16	4000	3000	1500	8000	3000	
08	1/2	4000	3000	1500	8000	3000	
09	9/16	4000	3000	1500	5000	3000	
10	5/8	4000	3000	1500	5000	3000	
11	11/16	4000	3000	1500	5000	3000	
12	3/4	4000	3000	1500	5000	3000	
13	13/16	4000	3000	1500	5000	3000	
14	7/8	4000	3000	1500	5000	3000	
15	15/16	4000	3000	1500	5000	3000	
16	1	4000	3000	1500	5000	3000	
20	1-1/4	4000	3000	1500	4000	3000	
24	1-1/2	2000	2000	1500	2000	2000	

Note: Dual∫Seal port size callout for tube O.D. 1-1/4 & 1-1/2 shall be 21 & 25 respectively. (See example of part number).

# **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



Note: Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.

- <u>+</u> AP8117	1 <u>– – – –</u> AP8015	1 <del>  1</del> 2 AP8117	1 - 2 AP8351	1 + + + + + + + + + + + + + + + + + + +
	A 3013	A10117	AI 0001	Ai 0343
AP8573	AP8784			

**Orbital Tube Weld Fittings and Equivalent Industry Standards** 

Fitting Shape	Port Sequ only	ence for Ai (See examp	rdrome Par ple of Part	Airdrome Standard	Aerospace Standard	
_	1	2	3	4		
T Ding					AP8117	AS1580
I-Killg						AS1893
Cap	W				AP8015	
Straight	W	W			AP8117	AS1585
45° Elbow	W	W			AP8351	
90° Elbow	W	W			AP8343	AS1584
Tee	W	W	W		AP8573	AS1583
Cross	W	W	W	W	AP8784	

Note:1. W = Orbital Tube Weld port.2. The AP and AS have the same configuration but are not interchangeable fittings.



Adapters for Orbital Tube Weld to Boss Fittings

Fitting Shape	Port Seque only (	Airdrome Standard			
	1	2	3	4	
Straight	М	W			AP8155
Straight	F	W			AP8169
45º Elbour	М	W			AP8378
43 E100W	F	W			AP8366
00º Elbour	М	W			AP8367
90 E100W	F	W			AP8368
	М	W	W		AP8625
	W	W	М		AP8626
	F	W	W		AP8627
	F	W	F		AP8628
Tee	F	F	W		AP8629
	М	W	F		AP8630
	F	W	М		AP8631
	М	F	W		AP8632
	W	W	F		AP8620
	М	W	W	W	AP8800
Creas	F	W	W	W	AP8801
Cross	F	W	W	М	AP8802
	М	F	W	W	AP8803

F	W	W	F	AP8804
F	F	W	W	AP8805
F	F	W	F	AP8806
М	F	W	F	AP8807

Note: 1. F = Female Boss port, M = Male Boss port, W = Orbital Tube Weld port.

1 2	1 1 2	1	1		
AP8115	AP8156	AP8157	AP8356	- AP8357	AP8358
1 1 2 2 AP8374	1 1 2 AP8329	1 1 2 AP8346	1 2 3 AP8601	1 1 2 3 AP8633	1 () 2 3 AP8596
AP 0002	AP0034	AP0035	AP 0595	AP 0030	AP6597
	1 1 2 3				
AP8599	AP8553	AP8603	AP8637	AP8638	AP8639
AP8640	AP8781	AP8808	AP8809	AP8787	AP8795
	3 1 1 2 4 AP8811		1 1 2 4 AP8813		
3	3	3	3	3	3
AP8788	AP8816	AP8817	AP8818	AP8819	AP8820
AP8821	AP8822	AP8823	I AP8824	AP8825	AP8826

Fitting Shape	Port Sequ only	Airdrome Standard			
Shupe	1	2	3	4	
	F	W			AP8115
Straight	М	W			AP8156
e	В	W			AP8157
	М	W			AP8356
45° Elbow	F	W			AP8357
	В	W			AP8358
	М	W			AP8374
90° Elbow	F	W			AP8329
	В	W			AP8346
	W	М	W		AP8601
	М	М	W		AP8633
	М	W	М		AP8596
	W	F	W		AP8602
	F	F	W		AP8634
	F	W	F		AP8635
	F	М	W		AP8595
-	М	W	F		AP8636
Tee	F	W	М		AP8597
	W	W	М		AP8599
	W	W	F		AP8553
	W	В	W		AP8603
	F	В	W		AP8637
	W	В	F		AP8638
	М	В	W		AP8639
	W	В	М		AP8640
	W	W	W	М	AP8781
	М	М	W	W	AP8808
	М	М	М	W	AP8809
	W	F	W	W	AP8787
	F	F	W	W	AP8795
	F	F	F	W	AP8810
	F	М	W	W	AP8811
	F	М	F	W	AP8812
Cross	F	М	М	W	AP8813
	М	М	F	W	AP8814
	F	F	М	W	AP8815
	W	В	W	W	AP8788
	М	В	W	W	AP8816
	F	В	W	W	AP8817
	М	В	М	W	AP8818
	F	В	F	W	AP8819
	F	B	M	W	AP8820

Adapters for Orbital Tube Weld to 37° Flared Fittings

М	В	F	W	AP8821
W	В	М	М	AP8822
W	В	F	F	AP8823
W	В	М	F	AP8824
W	В	М	W	AP8825
W	В	F	W	AP8826

Note:  $1. F = Female 37^{\circ} Flared port,$ 

M = Male 37° Flared port, B = Bulkhead 37° Flared male port, W = Orbital Tube Weld port.

1 1 2	1 1 2	1 - 2		1-	
AP8129	AP8135	AP8102	AP8379	AP8360	AP8362
			1 2 		
AP8340	AP8380	AP8328	AP8578	AP8617	AP8564
AP8610	AP8618	AP8641	AP8604	AP8642	AP8605
1	1	1 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	1 1 2 3 AP8645	1 2 	1 - 2 - 2 - 3 AP8555
AP8607	AP8789	AP8827	AP8828	AP8790	AP8829
1 1 2 4 AP8830	1 2 4 AP8831	1 2 AP8832	3 1 2 4 AP8833	1 1 4 AP8834	3 1 1 4 AP8835
3	3	3	3	· □ → 3	3
AP8791	AP8836	AP8837	AP8838	AP8839	AP8840
AP8841	AP8842	AP8843	AP8844	AP8845	AP8846

	Port Se	equence for	or Airdroi	me Part			
Fitting	Number	r only (Se	e example	e of Part	Airdrome	Aerospace	Military
Shape		N	0.)		Standard	Standard	Standard
_	1	2	3	4			
	F	W			AP8129	AS1581	MS21921
Straight	М	W			AP8135	AS1582	
	В	W			AP8102		
	F	W			AP8379		
45° Elbow	М	W			AP8360		
	В	W			AP8362		
	F	W			AP8340		
90° Elbow	М	W			AP8380		
	В	W			AP8328		
	W	М	М		AP8578		
	М	М	W		AP8617		
	М	W	W		AP8564		
	W	F	W		AP8610		
	F	F	W		AP8618		
	F	W	F		AP8641		
	F	М	W		AP8604		
T	М	W	F		AP8642		
lee	F	W	М		AP8605		
	W	В	W		AP8611		
	F	В	W		AP8643		
	W	В	F		AP8644		
	М	В	W		AP8645		
	W	В	М		AP8646		
	W	W	М		AP8555		
	W	W	F		AP8607		
	М	W	W	W	AP8789		
	М	М	W	W	AP8827		
	М	М	М	W	AP8828		
	F	W	W	W	AP8790		
	F	F	W	W	AP8829		
	F	F	F	W	AP8830		
	F	М	W	W	AP8831		
	F	М	F	W	AP8832		
Cross	F	М	М	W	AP8833		
	М	М	F	W	AP8834		
	F	F	М	W	AP8835		
	W	В	W	W	AP8791		
	М	В	W	W	AP8836		
	F	В	W	W	AP8837		-
	М	В	М	W	AP8838		
	F	В	F	W	AP8839		
	F	В	М	W	AP8840		

# Adapters for Orbital Tube Weld to 24° Flareless Fittings

М	В	F	W	AP8841	
W	В	М	М	AP8842	
W	В	F	F	AP8843	
W	В	М	F	AP8844	
W	В	М	W	AP8845	
W	В	F	W	AP8846	

Note: 1. F = Female 24° Flareless port, M = Male 24° Flareless port, B = Bulkhead 24° Flareless male port, W = Orbital Tube Weld port.

2. The AP and AS have the same configurations but are not interchangeable fittings.

					1
				2	2
AP421	AP6682	AP420	AP6671	AP6742	AP6725
1 2 AP6737	1 1 2 AP623	1 1 2 2 AP6702	1 1 2 2 AP6736	1 1 2 3 AP6842	1 - 2 - 2 3 AP657
1 - 2 - 2 3 AP6801	1 2 3 AP618	1 - 2 - 3 AP610	1 1 2 3 AP612	1 2 3 AP6809	1 1 2 3 AP6815
AP6850	AP6827	AP620/AP625	AP6086	AP6087	AP6088
		1 2	1 <b>1 2 3</b>		
AP6089	AP6090	AP6091	AP6092	AP6093	AP6904
3 1 1 2 4 AP6923	1 AP6900	1 + 2 4 AP6901	1 AP6924	1 + 2 AP6925	1 1 2 AP6926
1 1 2 AP6927	1 1 2 AP6928	3 1 ⊕ ↓ 2 ↓ 4 AP6929	3 1	1 AP6910	1 AP6961
	3	3	3	3	3
AP6931	AP6932	AP6933	AP6934	AP6935	AP6936

Eittin a	Port	Sequence	Airdromo	A		
Fluing	Number	only (See	example c	of Part No.)	Alfarome	Aerospace
Snape	1	2	3	4	Standard	Standard
	F	W			AP421	
G( 1)	F	W			AP6682	AS4227
Straight	М	W			AP420	AS4228
	В	W			AP6671	AS4229
	F	W			AP6742	
45° Elbow	М	W			AP6725	AS4230
	В	W			AP6737	AS4231
	F	W			AP623	
90° Elbow	М	W			AP6702	AS4232
	В	W			AP6736	
	F	W	М		AP6842	
	М	W	М		AP657	
	W	W	М		AP6801	
	М	W	W		AP618	
	F	W	W		AP610	
	F	F	W		AP612	
	F	W	F		AP6809	
	F	М	W		AP6815	
	М	W	F		AP6850	
т	М	М	W		AP6827	
Tee	W/	W	F		AP620	
	vv				*AP625	
	W	В	W		AP6086	
	F	В	W		AP6087	
	W	В	F		AP6088	
	М	В	W		AP6089	
	W	В	М		AP6090	
	W	W	В		AP6091	
	F	W	В		AP6092	
	М	W	В		AP6093	
	М	W	W	W	AP6904	
	М	М	W	W	AP6923	
	М	М	М	W	AP6900	
	F	W	W	W	AP6901	
	F	F	W	W	AP6924	
	F	F	F	W	AP6925	
Cross	F	М	W	W	AP6926	
	F	М	F	W	AP6927	
	F	М	М	W	AP6928	
	М	М	F	W	AP6929	
	F	F	М	W	AP6930	
	М	W	М	W	AP6910	
	М	W	W	F	AP6961	

# Adapters for Orbital Tube Weld to Dual Seal Fittings

W	В	W	W	AP6931
М	В	W	W	AP6932
F	В	W	W	AP6933
М	В	М	W	AP6934
F	В	F	W	AP6935
F	В	М	W	AP6936
М	В	F	W	AP6937
W	В	М	М	AP6938
W	В	F	F	AP6939
W	В	М	F	AP6940
W	В	М	W	AP6941
W	В	F	W	AP6942

Note: 1. F = Female Dual∫Seal port, M = Male Dual∫Seal port, B = Bulkhead Dual∫Seal port, W = Orbital Tube Weld port.
2. \* = A different part number assigned for reducers.

3. The AP and AS have the same configurations but are not interchangeable fittings.

# **BRAZE PERMANENT FITTING**



#### **DESIGN CONCEPT:**

Airdrome Precision Components, was a licensee of Douglas Aircraft Co. (prior to become Boeing Co.) for manufacturing Cres fittings commencing with DC-10 aircraft, was also the original manufacturer of Titanium Alloy Braze fittings starting with their MD-11 aircraft followed by the MD-80's and 90's. Braze fitting joints are known to be lightweight, high performance and extremely durable.

The braze cavity was designed to have a braze alloy ring pre-assembled on the inside of the fitting end for tube braze. When the fitting/tubing joint is clamped inside the tool to be brazed by induction heat coil. It will melt the braze alloy ring only and the material will flow evenly around to fill up the interface gap between fitting and tubing to form a permanent joint. The interface gap was designed to hold full filling of the melted braze alloy ring to assure full bounding for fluid sealing.

Any conventional induction heat coil set up can be used to braze these fittings. As an option for service, Boeing sub-contractors can also accomplish Brazing of fitting / tubing joints ready for tube installation.

While the superior performance of the Braze fittings offer the best of tube assembly connecting features, the separable fittings provide durability of permanent connections and offer the flexibility to interface with Boss, Flared, Flareless or DualISeal fitting ends providing an unrivaled fitting joint connection.

#### **DESIGN ADVANTAGES:**

- X Unified Brazed joints offers positive sealing.
- X Offers compact envelope, lightweight and durable service life.

#### STANDARD PROCUREMENT SPECIFICATIONS FOR BRAZE FITTINGS

SAE AS4459 and Military MIL-B-7883 specifications define Form, Fit, Function and Procurement requirements for Braze fittings.

# **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per Boeing S7928939 and 27D0002 specifications and are approved for use in various commercial programs at Boeing, Lockheed, etc.

#### FITTING AND BRAZE RING MATERIAL SELECTION

The Braze fittings and Braze Rings are offered in the following materials for use with various tubing materials, fluid and operating temperature:

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928.
Cres	Code JL	Indicates 304L per QQ-S-763.
	BRAZE RI	NG MATERIAL AND CODING
Gapasil	Code G	Indicates Gapasil # 9.
Silver	Code S Code V	Indicates class BAg - 19 silver wire per AWS A5.8 - 69. Indicates class BAg - 8a silver wire per AWS A5.8 - 62T
Gold	Code W	Indicates class BAu - 4 gold wire per AWS A5.8 - 62T or ASTM B260 - 62T.

#### FITTING MATERIAL AND CODING

COMPATIBILIT (Fitting Code)	Y OF FITTING, BRAZ (Braze Ring Code)	<b>ZE RING AND TUBING MATERIALS</b> (Tubing Material)
Т	G	Titanium Alloy 3AL-2.5V per AMS4944 or similar.
JL	S or W	Cres 21-6-9 per AMS5661 or similar.
JL	V	Cres 304L per MIL-T-8504, 304 1/8 Hard per MIL-T-6845, 321 per MIL-T-8808 or similar.

## SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING SIZE	TUBE O.D.	OPERATING PRESSURE (psi) PER FITTING MATERIAL Ti Alloy and Cres				
03	3/16	3000				
04	1/4	3000				
05	5/16	3000				
06	3/8	3000				
08	1/2	3000				
10	5/8	3000				
12	3/4	3000				
16	1	3000				
20	1-1/4	3000				

## TOOLING

Tube fabrication sub-contractors of Boeing are equipped to braze fittings. Commercially available induction coil tooling can also be used as option.

# **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.

$\oplus$	$\oplus$	$\oplus$	$\oplus$	1 - 2	1 - 2
AP2102	AP2103	AP2647	AP2186	AP2118	AP2119
1		1 - 2 3			
AP9329	AP2120	AP2112/AP2113	AP2125/AP2126	]	

	Po	rt Seq	uence	for			
Fitting Shape	Ai	rdrom e	Part N	0.	A irdrom e		
	(See	Examp	le of Pa	art No.)	Standard		
	1	2	3	4			
Gold Braze Ring					A P 2102		
Silver Braze Ring					A P 2103		
Silver Braze Ring					A P 2647		
Gapisal Braze Ring					A P 2186		
Straight	b	b			A P 2118		
					* A P 2 1 1 9		
45 deg. Elbow	b	b			A P 9329		
90 deg. Elbow	b	b			A P 2120		
Tee	b	b	b		A P 2112		
					* A P 2 1 1 3		
Cross	b	b	b	b	A P 2125		
					* A P 2 1 2 6		
Notes: 1. b = Tube	Notes: 1. b = Tube Braze port.						
2. * = A different part number assigned for reducers.							

1	1	1 1 2	1 2	1 2
AP2108/AP2165	AP2142	AP2115/2150	AP2111/AP2117	AP2197
1	1		1	1 ( 2
AP9326	AP2124	AP2136	AP9330	AP2122/AP2162
2 1 <b>⊕</b> ⊕ 2 3		1 - 2 - 2 - 3		
AP2191	AP2140	AP2160/AP2190	AP2138	AP2632/AP2698
		3 1 ⊕ ⊕ 2 ↓ 4 AP2175		
•				
	1 + 2 $AP2108/AP2165$ $1 + 2$ $AP9326$ $2 + 1 + 2$ $3$ $AP2191$ $2 + 1 + 2$ $3$ $AP2191$ $2 + 1 + 2$ $3$ $AP2130/AP2159$	1 + 2 $AP2108/AP2165$ $AP2142$ $1 + 2$ $AP9326$ $AP2124$ $2$ $AP9326$ $AP2124$ $1 + 2$ $3$ $AP2191$ $AP2140$ $2$ $1 + 2$ $3$ $AP2191$ $AP2140$ $2$ $1 + 2$ $4$ $AP2130/AP2159$ $AP2608$	$1 \bigoplus 2$ $1 \bigoplus 2$ $1 \bigoplus 2$ $AP2108/AP2165$ $AP2142$ $AP2115/2150$ $1 \bigoplus 2$ $2$ $AP3326$ $AP2124$ $AP2136$ $1 \bigoplus 2$ $1 \bigoplus 2$ $3$ $AP2191$ $AP2140$ $AP2160/AP2190$ $2$ $1 \bigoplus 2$ $3$ $AP2191$ $AP2140$ $AP2160/AP2190$ $2$ $1 \bigoplus 2$ $4$ $AP2160/AP2150$ $AP2175$	$1 \bigoplus 2$ $1 \bigoplus 2$ $1 \bigoplus 2$ $1 \bigoplus 2$ $AP2108/AP2165$ $AP2142$ $AP2115/2150$ $AP2111/AP2117$ $1 \bigoplus 2$ $2$ $AP3326$ $AP2124$ $AP2136$ $AP3330$ $1 \bigoplus 2$ $1 \bigoplus 2$ $1 \bigoplus 2$ $3$ $AP2131$ $AP2140$ $AP2160/AP2190$ $AP2138$ $AP2191$ $AP2191$ $AP2140$ $AP2160/AP2190$ $AP2138$ $AP2191$ $AP2190/AP2158$ $AP2190/AP2158$ $AP2608$ $AP2175$ $AP3775$

	Po				
Fitting Shape	Ai	Airdrome			
	(See Example of Part No.)				Standard
	1	2	3	4	
Coupling Nut					AP2109
Sleeve	F	b			AP2108
					*AP2165
Straight	F	b			AP2142
	М	b			AP2115
					*AP2150
	В	b			AP2111
					*AP2117
	В	b			AP2197
45 deg. Elbow	F	b			AP2134
-	М	b			AP9326
	В	b			AP2124
90 deg. Elbow	F	b			AP2136
-	М	b			AP9330
	В	b			AP2122
					*AP2162
Tee	b	F	F		AP2174
					*AP2674
	М	b	М		AP2191
	b	b	F		AP2140
	b	b	М		AP2160
					*AP2190
	F	b	b		AP2138
	М	b	b		AP2632
					*AP2698
	В	b	b		AP2128
	b	b	В		AP2130
					*AP2159
Cross	b	b	F	F	AP2608
	М	М	F	b	AP2175
	b	b	b	М	AP9775

Adapters for Tube Braze to 37 deg. Flared Fittings

Notes: 1. F = Female 37 deg. Flared port,

M = Male 37 deg. Flared port,

B = Bulkhead 37 deg. Flared male port,

b = Tube Braze port.2. \* = A different part number assigned for reducers.

	1 - 2	1 - 2	1 - 2	1 [2] 2	1
AP2109	AP2107/AP2167	AP2141	AP2114/AP2184	AP2110/AP2116	AP2133
1-122	1				
AP2194	AP2123/AP2177	AP2135	AP9325	AP2121/AP2151	AP2158
1 <b>() () ()</b> 2 <b>()</b> 3		1 2 2 	1 <del>[] [] ] 2</del> ↓ 3		1 - 2 
AP2147/AP2199	AP2139/AP2161	AP2164/AP2198	AP2137/AP2148	AP9553	AP2513
		1 ( 2 ) 2 3			
AP2189	AP9551	AP9552	AP2127/AP2146	AP2129/AP2152	AP9000
1 1 2 AP9776	1 ⊕ 3 1 ⊕ 2 ↓ 4 AP9778				

	Port Sequence for				
Fitting Shape	A	Airdrome			
	(See E	Exampl	Standard		
	1	2	3	4	
Coupling Nut					AP2109
Sleeve	F	b			AP2107
					*AP2167
Straight	F	b			AP2141
	М	b			AP2114
					*AP2184
	В	b			AP2110
					*AP2116
45 deg. Elbow	F	b			AP2133
	М	b			AP2194
	В	b			AP2123
					*AP2177
90 deg. Elbow	F	b			AP2135
	М	b			AP9325
	В	b			AP2121
					*AP2151
Tee	F	b	F		AP2158
	М	b	М		AP2147
					*AP2199
	b	b	F		AP2139
					*AP2161
	b	b	М		AP2164
					*AP2198
	F	b	b		AP2137
	-				*AP2148
	b	М	b		AP9553
	b	Μ	F		AP2513
	F	F	b		AP2189
	F	b	M		AP9551
	F	M	b		AP9552
	В	b	b		AP2127
			_		*AP2146
	b	b	В		AP2129
					^AP2152
Cross	b	b	M	M	AP9000
	M	b	b	b	AP9776
	М	b	Μ	b	AP9778

Adapters for Tube Braze to 24 deg. Flareless Fittings

Notes: 1. F = Female 24 deg. Flareless port,

M = Male 24 deg. Flareless port,

B = Bulkhead 24 deg. Flareless male port,

b = Tube Braze port.

2. \* = A different part number assigned for reducers.

# SHAPE MEMORY TUBE FITTING



#### **DESIGN CONCEPT:**

Shape Memory is a technology of cryogenic fit concept. Another supplier gave the same fitting a tradename Cryofit. It is a coupling made of Tinel material – half Titanium and half Nickel. The coupling is machined to predetermined dimensions with the I.D. smaller than the tube O.D. Passing a mandrel through the coupling I.D. while submerged in liquid nitrogen at cryogenic temperature will expand the coupling. It will remain as expanded while submerged in liquid nitrogen. When the coupling is installed to couple two pieces of tubing together, it will automatically return to its predetermined dimensions when exposed to room temperature. The shape memory is the result of a change in the crystal structure of the alloy known as reversible austenite to martensite phase transformation.

Shape Memory tube fittings were designed to work with Tinel couplings to provide separable fitting connections in elbow, tee and cross configurations. These fittings were uniquely designed to be compatible for assembly with Tinel couplings on tube ends. Each of these Cryofit joints offers .125 of an inch for tube insertion tolerance that minimize pre-stress caused by stack-up tolerance during hydraulic line installation.

The Shape Memory joints are easy to install. Simply position the coupling on the pre-marked fitting/tubing joint and let the shape memory does the rest of the work within seconds. The coupling material itself accomplishes the crimping leaving no room for human errors. Thus, anticipation of positive sealing in each joint is assured.

#### **DESIGN ADVANTAGES:**

- X Positive sealing is assured by constant crimping force of the coupling material over differential tube material resistant strength.
- X Shape Memory fitting joints are easy to install either in production or field repair.
- **C** No special tooling is required except standard torque wrenches and a pair of tongs.

#### STANDARD PROCUREMENT SPECIFICATION FOR SHAPE MEMORY TUBE FITTINGS

SAE AS4459 specification defines Form, Fit, Function and Procurement requirements for Shape Memory Tube fittings.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified to meet SAE AS18280 & AS4459, Military MIL-F-18280 & MIL-F-85421 and Northrop 37A050 specifications.

The fittings are approved for use in various military programs at Boeing, Northrop/Grumman, Vought, etc.

#### FITTING MATERIAL SELECTION

The Shape Memory Tube fitting is made out of 6AL-4V Titanium Alloy per AMS4928 or AMS4965 for use on 3AL-2.5V Titanium Alloy tubing per AMS4944 for various fluids and operating temperature.

Recommended tubing wall for fitting installation is per MIL-F-85421.

#### SIZE VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size. The following shows standard size range and corresponding operating pressures:

FITTING	TUBE	<b>OPERATING PRESSURE</b> (psi)
 SIZE	O.D.	PER FITTING MATERIAL
04	1/4	4000
06	3/8	4000
08	1/2	4000
10	5/8	4000
12	3/4	4000
14	7/8	4000
16	1	4000
20	1-1/4	4000
24	1-1/2	1500

**Note:** Dual/Seal port size callout for tube O.D. 1-1/4 & 1-1/2 shall be 21 & 25 respectively. (See example of part number.)

#### TOOLING

It requires only a pair of tongs, a pair of gloves and a marking pen for fitting installation.

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.



Shape Memory Tube Fittings						
Fitting Shape	Port Sequence for Airdrome Part No. only (See Example of Part No.)				Airdrome Standard	
	1	2	3	4		
Straight	Т				AP3708	
	В	Т			AP3700	
45 deg. Elbow	Т	Т			AP3751	
	В	Т			AP3752	
90 deg. Elbow	Т	Т			AP3750	
	В	Т			AP3753	
Tee	Т	Т	Т		AP3148	
	В	Т	Т		AP3802	
	Т	Т	В		AP3801	
Cross	Т	Т	Т	Т	AP3850	
Nata d T Ohana Manaana Tala alah						

Note: 1. T = Shape Memory Tube port,

B = Bukhead Shape Memory Tube port.

1 - 1 - 2	1	<sup>1</sup> ∰⊟ <sup>2</sup>	1	1	1				
AP3109	AP3108	AP3107	AP3128	AP3129	AP3124				
1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	1 1 2 AP3121	1	1 1 2 3 AP3154	1 2 2 3 AP3149	1 - <b>1</b> - 2 - 3 AP3152				
1 - II - 2 	1 2 	1 1 2 2 AP3159	1 2 2 3 AP3160	1 2 2 3 AP3161	1 2 2 3 AP3166				
1 2 2 3 AP3155	1 2 2 3 AP3167	1 1 2 2 3 AP3162	1 1 2 AP3164	1 1 2 2 3 AP3168	1 1 2 3 AP3169				
1 - III - 2 3 AP3156	1 1 1 1 1 1 2 3 AP3153	1 - <b>I</b> - 2 3 AP3157	1	1	3 1 2 2 2 2 2 2 2				
	1			1					
	to 24 deg. Flateless Fittings								
---------------	-------------------------------	---------	---------	----------	---------	--	--	--	--
	Port Sequence for								
Fitting Shape		Airdror	t No.	Airdrome					
	(See E	xampl	rt No.)	Standard					
	1	2	3	4					
Straight	Μ	Т			AP3109				
	F	Т			AP3108				
	В	Т			AP3107				
45 deg. Elbow	М	Т			AP3128				
	F	Т			AP3129				
	В	Т			AP3124				
90 deg. Elbow	Μ	Т			AP3127				
-	F	Т			AP3121				
	В	Т			AP3125				
					*AP3126				
Tee	М	Т	Т		AP3154				
	F	Т	Т		AP3149				
	Т	Т	М		AP3152				
	Т	Т	F		AP3150				
	М	Т	М		AP3158				
	Μ	Т	F		AP3159				
	F	Т	М		AP3160				
	F	Т	F		AP3161				
	М	М	Т		AP3166				
	F	М	Т		AP3155				
	F	F	Т		AP3167				
	В	Т	M		AP3162				
	В	Т	F		AP3164				
	Μ	В	Т		AP3168				
	F	В	Т		AP3169				
	В	Т	Μ		AP3156				
	В	Т	Т		AP3153				
	Т	Т	В		AP3157				
	М	Т	В		AP3163				
	F	Т	В		AP3165				
Cross	F	М	Т	В	AP3861				

# Adapters for Shape Memory to 24 deg. Flareless Fittings

Notes: 1. F = Female Flareless port, M = Male Flareless port, B = Bulkhead Flareless or Shape Memory Tube ports,

T = Shape Memory Tube port.

2. \* = A different part number assigned for reducers.

1 - 2	1-2	1 <sup>2</sup>	1	1	1
AP3712	AP3709	AP3701	2 AP3768	2 AP3756	2 AP3754
1	1 1 2 AP3758	1	1 1 2 2 3 AP3820	1 - IL	1 2 2 
1	1 2 	1 2 2 AP3823	1 2 2 3 AP3824	1 2 3 AP3825	1 2 2 3 AP3830
1 1 2 3 AP3831	1 1 2 2 3 AP3832	1 2 2 3 AP3807	1 2 2 3 AP3826		1 1 2 3 AP3834
		1		3 1 + 2 4 AP3859	

Fitting Shape	Po Aiı (See E	ort Sequ drome Example	or o. t No.)	Airdrome Standard	
	1	2	3	4	
Straight	М	Т			AP3712
	F	Т			AP3709
	В	Т			AP3701
45 deg. Elbow	М	Т			AP3768
	F	Т			AP3756
	В	Т			AP3754
90 deg. Elbow	М	Т			AP3769
	F	Т			AP3758
	В	Т			AP3755
Tee	М	Т	Т		AP3820
	Т	F	Т		AP3804
	Т	Т	М		AP3821
	Т	Т	F		AP3803
	М	Т	М		AP3822
	М	Т	F		AP3823
	F	Т	М		AP3824
	F	Т	F		AP3825
	М	М	Т		AP3830
	М	F	Т		AP3831
	F	F	Т		AP3832
	В	Т	Т		AP3807
	В	Т	М		AP3826
	В	Т	F		AP3828
	F	В	Т		AP3834
	М	В	Т		AP3833
	В	Т	Т		AP3809
	М	Т	В		AP3827
	F	Т	В		AP3829
Cross	F	Т	Т	М	AP3859
	F	В	Т	М	AP3860

Adapters for Shape Memory to	Dual S	Seal Fittings
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Note: 1. F = Female Dual Seal port, M = Male Dual Seal port, B = Bulkhead Dual Seal male port, T = Shape Memory Tube port.

### **EXTERNALLY SWAGED FITTING**



### **DESIGN CONCEPT**

The Externally Swaged fitting was originally developed by McDonnell Douglas (prior to become Boeing) who granted the manufacturing authority to Airdrome Precision Components. Another supplier gave the same fitting a tradename Permaswage.

After the patent was expired in 1991, Airdrome Precision Components improved the fitting design concept by lower the fitting yield strength slightly to increase significantly broader fitting application for use on softer tubing materials and/or thinner tube wall. It has also enhanced swaging tool life.

The unique geometric of the fitting design has a body and tail connected by a thinner wall mid section. It creates a flexible tail to absorb vibration and bending in flight conditions while static sealing takes place in the body section.

Externally Swaged fittings were designed for permanently assembled onto tubing by crimping with swaging tool. Each fitting offers .300 of an inch for tube insertion tolerance that minimizes pre-stress caused by stack-up tolerances during hydraulic line installation. This advantage can also be utilized by installing an union for repair of small tube defects less than .300 of an inch.

Fitting materials are available in Aluminum Alloy, Cres and Titanium for use with various tubing materials. Each fitting tail I.D. is coated with Teflon for lubrication to enhance stress relief on fitting joints under bending or vibration conditions. The Teflon finish is also colored differently for fitting material identification and surface protection purposes. For 3,000 psi rated fittings: Green Teflon is coated on inside and outside of Aluminum Alloy and inside of Cres fittings only, black Teflon is coated on inside and outside of Titanium fittings. For 4,000 psi rated fittings: Blue Teflon is coated on inside and outside of Titanium fittings.

Each fitting end has two internal grooves for baked on silicone seal. Double silicone seal is required on Aluminum Alloy fittings for use on Aluminum Alloy tubing. Single silicone seal is sufficient on Cres and Titanium fittings for use on Cres and Titanium Alloy tubing. It is however, recommended that optional double silicone seal (to add suffix code Y in part number) should be used on all fittings.

#### **DESIGN ADVANTAGES:**

- Sealing efficiency eliminates unnecessary down time and high repair cost.
- Large tube insertion tolerance minimizes pre-stress within hydraulic systems.
- Ext-Swage fittings are easy to install either in production or field repair.
- Ext-Swage fittings are compatible for use with Boss, Flared, Flareless and Dual/Seal separable fitting ends.

# STANDARD PROCUREMENT SPECIFICATION FOR EXTERNALLY SWAGED FITTINGS

SAE AS4459 specification defines Form, Fit, Function and Procurement requirements for Ext-Swage fittings.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified to meet SAE AS18280 & AS4459, MIL-F-18280 & MIL-F-85421 and Boeing 27D0001 & BPS-F-142 specifications. The fittings are approved for use in various military and commercial programs at AIDC, CASA, Boeing, Bombardier, Cessna, Lockheed, Textron Marine, etc.

#### FITTING MATERIAL SELECTION

The 3000 psi rated Adapters and Permanent Ext-Swage fittings are offered in the following materials for use with various tubing materials, fluid and operating temperature:

MATERIAL .	AND	CODING
------------	-----	--------

Titanium	Code T	Indicates commercially pure Titanium per AMS4921.
Cres	Code -	Indicates 21-6-9 per AMS5656 not to exceed 65,000 psi yield strength.
Aluminum Alloy	Code D	Indicates 6061-T6 per QQ-A-225/8 except overaged to 23,000 and 33,000 psi yield strength.

#### COMPATIBILITY OF FITTING AND TUBING MATERIALS (Recommended tube wall per AS18280, AS4459, MIL-F-18280 & MIL-F-85421) (Fitting Code) (Tubing material)

Т	Titanium Alloy 3AL-2.5V per AMS4944 or similar.
-	Titanium Alloy 3AL-2.5V per AMS4944 or, Cres 21-6-9 per AMS5561 or, Cres 304 1/8 Hard per MIL-T-6845 or, Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.
D	Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.

#### TOOLING

Deutsch D12xxx or DLT tooling designed for swaging fittings to meet as qualified fitting performance swages all fittings. Established Form, Fit and Function of all suppliers' fittings are fully defined and controlled by Boeing (formally McDonnell Douglas) and other major worldwide OEM specifications.

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

TUBE	OPERATING PRE PER FITTING M	CSSURE (psi) IATERIAL
O.D.	Titanium & Cres	Alum Alloy
3/16	3000	1000
1/4	3000	1000
5/16	3000	1000
3/8	3000	1000
1/2	3000	1000
5/8	3000	1000
3/4	3000	1000
1	3000	1000
1-1/4	3000	1000
1-1/2	2000	1000
	<b>TUBE</b> <b>O.D.</b> 3/16 1/4 5/16 3/8 1/2 5/8 3/4 1 1-1/4 1-1/2	OPERATING PRE PER FITTING M           O.D.         Titanium & Cres           3/16         3000           1/4         3000           5/16         3000           3/8         3000           1/2         3000           5/8         3000           3/4         3000           1         3000           1-1/4         3000           1-1/2         2000

Note: DualISeal port size callout for tube O.D. 1-1/4 & 1-1/2 shall be 21 & 25 respectively.

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**





3000 psi rated Ext-Swage Fittings and Equivalent Industry Standards

	Port Sequence for					
Fitting Shape	Airdrome Part No. only				Airdrome	Aerospace
	(See E	Examp	le of P	art No.)	Stand ard	Stand ard
	1	2	3	4		
Сар	S				AP10145	
Straight	S	S			AP10100	AS5008
	S	В			AP10116	
					AP10122	
					AP10136	
					AP10148	
45 deg. Elbow	S	S			AP10358	
	В	S			AP10336	
					AP10338	
					AP10339	
90 deg. Elbow	S	S			AP10101	AS5009
	В	S			AP10334	
					AP10362	
Tee	S	S	S		AP10102	AS5010
	В	S	S		AP10584	
	S	S	В		AP10586	
Cross	S	S	S	S	AP10103	AS5011
	В	S	S	S	AP10783	

Note: 1. S = Ext-Swage port, B = Bulkhead Ext-Swage port.

$\frac{1}{45 \text{ deg}. E \text{ lbow}} = \frac{1}{12} = 2 + \frac{1}{4} = $	1 - 1 - 2 AP10173	1	2	1 1 AP10384	1-	AP10378	1 -	1
$\frac{1}{4}$ $\frac{1}$	1 - 3 4P10607	1 <u></u> - → → → → → → → → → →		1	-2 1 <u>-</u>		2 1	1
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	1 2 3 AP10611	1				AP10794	2 1	2 1
A dapters for 3000 psi rated Ext-Swage to Boss FittingsFitting ShapePort Sequence for Airdrom e Part No. StandardAirdrom e StandardFitting ShapePort Sequence for Airdrom e Part No. StandardAirdrom e StandardS traightMSAP10173 AP1016145 deg. ElbowMSAP10384 AP1037890 deg. ElbowFSAP10379 AP10379TeeMSAP100607 SFSAP10608 AP10560 *AP10561FSAP10561 AP10561	1				2 1-	AP10799	2 1 2 4 AP10800	
F       F       S       A P 10610         M       S       F       A P 10611         M       S       F       A P 10612         M       F       S       M       A P 10613         Cross       M       F       S       A P 10613         M       F       S       S       A P 10794         F       S       S       S       A P 10794         F       S       S       S       A P 10792         F       S       S       A P 10795         M       F       S       S       A P 10795         M       F       S       S       A P 10797         F       S       S       F       A P 10797         F       S       S       F       A P 10797         F       F       S       F       A P 10798         M       F       S       F       A P 10798         M       F       S       S       A P 10799         F       F       S       S       A P 10799         M       F       S       S       A P 10799         M       F       S       S								

	1 - 3 2	1 - 2	1-1-1-1-1-1-2	1	
AP10006	AP10107	AP10108	AP10174	AP10109	AP10373
1 1 2 AP10352	1 1 2 AP10374	1 + + + + + + + + + + + + + + + + + + +	1	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1 ⊕
1 = 2 3 AP10550	1 ∰	1 - 2 	1 1 2 3 AP10593	1 = - + - = 2 AP10590	1 - 2 - 2 - 3 AP10616
1 1 2 3 AP10617	1 1 2 2	1 + 2 + 2 = 2 3 AP10589	1	1 2 2 4 4 4 4 4 4 4 4 4 4 4 4 4	1 1 2 3 AP10620
AP10621 1 1 2 2 AP10621 2 4 AP10621	AP10623 1 1 4 AP10802	AP10024		AP10619	AP 10622

	Port Sequence for					
Fitting Shape	Airdrome Part No. only			Airdrome	Aerospace	
	(See E	Exampl	e of Pa	rt No.)	Standard	Standard
	1	2	3	4		
Coupling Nut					AP10006	
Sleeve	F	S			AP10106	
Straight	S	Μ			AP10110	AS5013
					*AP10121	
	F	S			AP10123	AS5267
					* AP10151	
	В	S			AP10105	
45 deg. Elbow	М	S			AP10356	
	F	S			AP10353	
	В	S			AP10335	
90 deg. Elbow	Μ	S			AP10329	
	F	S			AP10327	
	В	S			AP10331	
Tee	М	S	S		AP10559	
	S	S	М		AP10552	
	М	S	М		AP10580	
	М	Μ	S		AP10625	
	F	S	S		AP10567	
	S	S	F		AP10566	
	F	S	F		AP10582	
	F	F	S		AP10626	
	М	S	F		AP10568	
	F	S	М		AP10595	
	F	Μ	S		AP10562	
	S	В	S		AP10554	
	В	S	М		AP10628	
	М	В	S		AP10629	
	В	S	F		AP10631	
	F	В	S		AP10632	
	S	S	В		AP10553	
	М	S	В		AP10627	
	F	S	В		AP10630	
Cross	М	S	S	S	AP10778	
	Μ	Μ	S	S	AP10781	

Adapters for 3000 psi rated Ext-Swage to 24 deg. Flareless Fittings

Notes: 1. F = Female 24 deg. Flareless port,

M = Male 24 deg. Flareless port,

B = Bulkhead 24 deg. Flareless male port,

S = Ext-Swage port.

2. \* = A different part number assigned for reducers.

	1 2	1 🚛 🕕 2	1-1-1-1-12	1	1-00
AP10006	AP10106	AP10110/AP10121	AP10123/AP10151	AP10105	2 AP10356
1 1 2 AP10353	1-1-2 AP10335	1	1 +	1	1 - 1 - 2 3 AP10559
1 =	1 - 1 - 2 - 2 2 3 AP10580	1 2 	1 - 2 3 AP10567	1 = - + - = 2 AP10566	1 - 2 3 AP10582
1 1 2 3 AP10626	1 - [] - = = 2 3 AP10568	1 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 +	1 - 2 - 2 - 3 AP10562	1 2 4 4 2 4 3 3 4 2 4 5 5 4	1 2 2 3 AP10628
AP10629 1	AP10631 1 2 2 2 2 2 2 2 2 2 2	AP10632	AP10553	AP10627	AP10630

	Port Sequence for					
Fitting Shape	Aird	rome P	art No.	Airdrome	Aerospace	
0 1	(See E	Example	e of Pa	Standard	Standard	
	<u>1</u>	2	3	4		
Coupling Nut					AP10006	
Sleeve	F	S			AP10107	AS5012
Straight	М	S			AP10108	
	F	S			AP10174	AS5266
	В	S			AP10109	
45 deg. Elbow	М	S			AP10373	
	F	S			AP10352	
	В	S			AP10374	
90 deg. Elbow	М	S			AP10371	
Ű	F	S			AP10325	
	В	S			AP10351	
Tee	М	S	S		AP10614	
	S	S	М		AP10550	
	М	S	М		AP10588	
	М	М	S		AP10615	
	F	S	S		AP10593	
	S	S	F		AP10590	
	F	S	F		AP10616	
	F	F	S		AP10617	
	М	S	F		AP10618	
	F	S	Μ		AP10589	
	М	F	S		AP10587	
	В	S	S		AP10594	
	В	S	М		AP10620	
	М	В	S		AP10621	
	В	S	F		AP10623	
	F	В	S		AP10624	
	S	S	В		AP10591	
	М	S	В		AP10619	
	F	S	В		AP10622	
Cross	Μ	S	S	S	AP10801	
	F	S	S	S	AP10802	
	В	S	S	S	AP10803	

Adapters for 3000 psi rated Ext-Swage to 37 deg. Flared Fittings

Note: 1. F = Female 37 deg. Flared port,

M = Male 37 deg. Flared port,

B = Bulkhead 37 deg. Flared male port,

S = Ext-Swage port.



Fitting Shape	Port Sequence for Airdrome Part No. only (See Example of Part No.)			Airdrome Standard	Aerospace Standard	
	1	2	3	4		
Straight	М	S			AP12103	AS4215
	F	S			AP12102	AS4234
	В	S			AP12104	AS4217
45 deg. Elbow	М	S			AP12335	AS4218
	F	S			AP12329	
	В	S			AP12334	AS4219
90 deg. Elbow	Μ	S			AP12336	AS4225
	F	S			AP12327	
	В	S			AP12328	AS4226
Tee	М	S	S		AP12559	
	S	S	М		AP12552	
	М	S	М		AP12560	
	М	М	S		AP12573	
	F	S	S		AP12551	
	S	S	F		AP12550	
	F	S	F		AP12561	
	F	F	S		AP12562	
	М	S	F		AP12563	
	F	S	М		AP12564	
	Μ	F	S		AP12565	
	В	S	S		AP12554	
	В	S	М		AP12566	
	М	В	S		AP12567	
	В	S	F		AP12568	
	F	В	S		AP12569	
	S	S	В		AP12570	
	Μ	S	В		AP12571	
	F	S	В		AP12572	
Cross	М	S	S	S	AP12776	
	М	S	S	F	AP12777	

Adapters for 3000 psi rated Ext-Swage to Dual Seal Fittings

Note: 1. F = Female Dual/Seal port, M = Male Dual Seal port,

B = Bulkhead Dual Seal male port,

S = 3000 psi rated Ext-Swage port.

#### FITTING MATERIAL SELECTION

The 4000 psi rated Adapters and Permanent Ext-Swage fittings are offered in the following materials for use with various tubing materials, fluid and operating temperature:

		MATI	ERIAL AND CODING
Titanium	Code	Т	Indicates commercially pure Titanium per AMS4921.
Aluminum Alloy	Code	D	Indicates 6061-T6 per QQ-A-225/8 except overaged to 23,000 and 33,000 psi yield strength.
COMPA	TIBILITY (Recomm (Fitting C	7 OF F ended ode)	ITTING AND TUBING MATERIALS tube wall per MIL-F-85421.) (Tubing material)
	Т	Titan	ium Alloy 3AL-2.5V per AMS4944 or similar.

MAREDIAL AND CODING

## SIZE AND MATERIAL VERSUS OPERATING PRESSURE

D

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.

FITTING	TUBE	OPEKATING PRESSURE (psi) PER FITTING MATERIAL			
SIZE	O.D.	Titanium	Alum Alloy		
04	1/4	4000	1000		
06	3/8	4000	1000		
08	1/2	4000	1000		
10	5/8	4000	1000		
12	3/4	4000	1000		
16	1	4000	1000		
20	1-1/4	4000	1000		
24	1-1/2	2000	1000		

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



1 =	1 = 2	1			1 =
AP11001	AP11108	AP11116	AP11326	AP11338	AP11333
1 = 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +	1 - 2 3 AP11552	AP11562	1 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2	1 = - + - = 2 AP11776	AP11777

Fitting Shape	Port Sequence for Airdrome Part No. only (See Example of Part No.)			Airdrome Standard	
	1	2	3	4	e tandara
Сар	S				AP11001
Straight	S	S			AP11108
	S	В			AP11116
45 deg. Elbow	S	S			AP11326
	В	S			AP11338
90 deg. Elbow	S	S			AP11333
	В	S			AP11337
Tee	S	S	S		AP11552
	В	S	S		AP11562
	S	S	В		AP11563
Cross	S	S	S	S	AP11776
	В	S	S	S	AP11777

4000 psi rated Ext-Swage Fittings

Note: 1. S = Ext-Swage port, B = Bulkhead Ext-Swage port.

1 2	1	1	1-01	1	1
AP11106	AP11105	AP11107/AP11110	AP11339	AP11336	- AP11332
				1 =	1-1-2 2 3
AP11334	AP11331	AP11335	AP11558	AP11555	AP11564
1 - [] - 2 	1 1 2 3 AP11556	1 = - + - = 2 AP11553	1 - 2 3 AP11566	1 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 + 2 +	1 - [] (
1 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 -	1 1 2 3 AP11560	1 2 1 2 2 1 2 2 1 2 2 1 2 1 2 1 2 1 2 1	1 2 3 AP11561	1 2	1 2 
		1 1 2	1 - 2 - 3		
AP11572	AP11554	AP11573	AP11574	AP11778	AP11779

	P	ort Sec	iuence	for	
Fitting Shape	A	lo.	Airdrome		
	(See E	Exampl	rt No.)	Standard	
	1	2	3	4	
Staright	S	M	-		AP11106
etsitight	F	S			AP11105
	S	B			AP11107
	-				*AP11110
45 deg. Elbow	М	S			AP11339
5	F	S			AP11336
	В	S			AP11332
90 deg. Elbow	М	S			AP11334
0	F	S			AP11331
	В	S			AP11335
Tee	М	S	S		AP11558
	S	S	М		AP11555
	М	S	М		AP11564
	М	М	S		AP11565
	М	S	S		AP11556
	S	S	М		AP11553
	F	S	F		AP11566
	F	F	S		AP11567
	М	S	F		AP11568
	F	S	М		AP11569
	F	Μ	S		AP11560
	В	S	S		AP11557
	В	S	М		AP11561
	М	В	S		AP11570
	В	S	F		AP11571
	F	В	S		AP11572
	S	S	В		AP11554
	М	S	В		AP11573
	F	S	В		AP11574
Cross	М	S	S	S	AP11778
	М	М	S	S	AP11779

# Adapters for 4000 psi rated Ext-Swage to 24 deg. Flareless Fittings

Notes: 1. F = Female 24 deg. Flareless port,

M = Male 24 deg. Flareless port,

B = Bulkhead 24 deg. Flareless male port,

S = 4000 psi rated Ext-Swage port.

2. \* = A different part number assigned for reducers.

#### FITTING MATERIAL SELECTION

The 4000 psi rated Adapters and Permanent Ext-Swage fittings are offered in the following materials for use with various tubing materials, fluid and operating temperature:

		MATI	ERIAL AND CODING
Titanium	Code	Т	Indicates commercially pure Titanium per AMS4921.
Aluminum Alloy	Code	D	Indicates 6061-T6 per QQ-A-225/8 except overaged to 23,000 and 33,000 psi yield strength.
COMPA	TIBILITY (Recomm (Fitting C	7 OF F ended ode)	ITTING AND TUBING MATERIALS tube wall per MIL-F-85421.) (Tubing material)
	Т	Titan	ium Alloy 3AL-2.5V per AMS4944 or similar.

MAREDIAL AND CODING

## SIZE AND MATERIAL VERSUS OPERATING PRESSURE

D

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.

FITTING	TUBE	OPEKATING PRESSURE (psi) PER FITTING MATERIAL			
SIZE	O.D.	Titanium	Alum Alloy		
04	1/4	4000	1000		
06	3/8	4000	1000		
08	1/2	4000	1000		
10	5/8	4000	1000		
12	3/4	4000	1000		
16	1	4000	1000		
20	1-1/4	4000	1000		
24	1-1/2	2000	1000		

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



- X Offers a compact envelope, lightweight and strong fitting joint.
- X Assembly of tube assemblies can be made in place for production and repair applications.

#### STANDARD PROCUREMENT SPECIFICATIONS FOR INTERNALLY SWAGED TO DUAL/SEAL FITTINGS

SAE AS4459 or Military MIL-F-85421 specifications define Form, Fit, Function and Procurement requirements for Int-Swage to DualISeal sleeves.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per AS4459 and MIL-F-85421 specifications and are approved for use in various military, space and commercial programs at AIDC, Allison, British Aerospace, Boeing, Lockheed, Northrop/Grumman, Sikorsky, etc.

#### FITTING MATERIAL SELECTION

The fittings are offered in the following materials for use with various tubing materials, fluid and operating temperature:

#### MATERIAL AND CODING

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4965.
Cres	Code N Code P	Indicates Inconel 718 per AMS5663. Indicates 17-4PH, H-1075 cond. per AMS5643.

<b>COMPATIBILITY OF FITTIN</b>	NG AND TUBING MATERIALS
(Recommended tube wall pe	er AS4459 and MIL-F-85421)
(Fitting Material)	(Tubing material)

Ti Alloy	Titanium Alloy 3AL-2.5V per AMS4944 or, Cres 21-6-9 per AMS5661 or
	Cres 304 1/8Hd. per MIL-T-6845 or,
	Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.
Cres	Cres 21-6-9 per AMS5661 or, Cres 304 1/8Hd. per MIL-T-6845 or similar.

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING	TURE	OPERATING PRESSURE (p PER FITTING MATERIA)				
SIZE	O.D.	Ti Alloy	Cres			
03	3/16	5000	3000			
04	1/4	5000	3000			
05	5/16	5000	3000			
06	3/8	5000	3000			
08	1/2	5000	3000			
10	5/8	5000	3000			
12	3/4	5000	3000			
14	7/8	4000	3000			
16	1	4000	3000			
20	1-1/4	4000	3000			

Note: DualISeal port size callout for tube O.D. 1-1/4 shall be 21. (See example of part number.)

#### TOOLING

Airdrome fittings are qualified and fully compatible to be swaged by Resistoflex swage tooling. Thus, redundant procurement of Airdrome tooling can be eliminated to benefit our focus on quick fitting deliveries.

# EXAMPLE OF PART NUMBER FOR ORDERING INTERNALLY SWAGED TO DUAL/SEAL FITTINGS



1-2-2		1 —	2		1[]	2
AP642 & AP442		AP6	40 & AP440		AP6	41 & AP441
1				2		
AP644 & AP444		AP6	43 & AP443		AP6	45 & AP445
Int-Swage to	Dual/Seal S	Sleeve and Eq	uivalent Industr	y Standa	ards	
Int-Swage to	Dual/Seal S Port Se	Sleeve and Eq quence for	uivalent Industr	ry Standa	ards	
Int-Swage to Fitting Shape	Dual/Seal S Port Se Aordrome (See Examp	Dieeve and Eq quence for Part No. only ple of Part No.)	uivalent Industr Airdrom e Standard	<b>y Standa</b> Aerospa Standar	ards ce cd	
Int-Swage to Fitting Shape	Dual/Seal S Port Se Aordrome (See Examp 1	Dieeve and Eq quence for Part No. only ple of Part No.) 2	uivalent Industr Airdrome Standard	y Standa Aerospa Standar	ards ce d	
Int-Swage to Fitting Shape Straight	Dual/Seal S Port Se Aordrome (See Examp 1 F M	Gleeve and Eq quence for Part No. only ple of Part No.) 2 S	uivalent Industr Airdrome Standard AP642 & AP442 AP640 & AP440	y Standa Aerospa Standar AS4203	ards ce rd	
Int-Swage to Fitting Shape Straight (Short sleeves for production)	Dual/Seal S Port Se Aordrome (See Examp 1 F M B	Sleeve and Eq quence for Part No. only ple of Part No.) 2 S S S	uivalent Industr Airdrome Standard AP642 & AP442 AP640 & AP440 AP641 & AP441	y Standa Aerospa Standar AS4203 AS4216	ards ce d	
Int-Swage to Fitting Shape Straight (Short sleeves for production) Straight	Dual/Seal S Port Se Aordrome (See Examp 1 F M B F	Sleeve and Eq quence for Part No. only ple of Part No.) 2 S S S S S	uivalent Industr Airdrome Standard AP642 & AP442 AP640 & AP440 AP641 & AP441 AP644 & AP444	y Standa Aerospa Standar AS4203 AS4216	ards ce d	
Int-Swage to Fitting Shape Straight (Short sleeves for production) Straight (Long sleeves	Dual/Seal S Port Se Aordrome (See Examp 1 F M B F M M	Sleeve and Eq quence for Part No. only ple of Part No.) 2 S S S S S S	uivalent Industr Airdrome Standard AP642 & AP442 AP640 & AP440 AP641 & AP441 AP644 & AP444	Aerospa Standar AS4203 AS4216	ards ce d	
Int-Swage to Fitting Shape Straight (Short sleeves for production) Straight (Long sleeves for repair)	Dual/Seal S Port Se Aordrome (See Examp 1 F M B F M B F M B B B	Gleeve and Eq quence for Part No. only ple of Part No.) 2 S S S S S S S S	uivalent Industr Airdrome Standard AP642 & AP442 AP640 & AP440 AP641 & AP441 AP644 & AP444 AP643 & AP443 AP645 & AP445	y Standa Aerospa Standar AS4203 AS4216	ards ce cd	
Int-Swage to Fitting Shape Straight (Short sleeves for production) Straight (Long sleeves for repair) Notes: 1. F =	Dual/Seal S Port Se Aordrome (See Exam) 1 F M B F M B F emale port,	Gleeve and Eq quence for Part No. only ple of Part No.) 2 S S S S S S M = Male port	uivalent Industr Airdrome Standard AP642 & AP442 AP640 & AP440 AP641 & AP441 AP644 & AP444 AP643 & AP443 AP645 & AP445 , B = Bulkhead m	y Standa Aerospa Standar AS4203 AS4216 ale port.	ards Ce rd	
Int-Swage to Fitting Shape Straight (Short sleeves for production) Straight (Long sleeves for repair) Notes: 1. F = 2. AP6	Dual/Seal S Port Se Aordrome (See Examp 1 F M B F F M B F emale port, ixx assigned	Sleeve and Eq quence for Part No. only ple of Part No.) 2 S S S S S M = Male port for Int-Swage	uivalent Industr Airdrom e Standard AP642 & AP442 AP640 & AP440 AP641 & AP441 AP644 & AP444 AP643 & AP443 AP645 & AP443 AP645 & AP445 , B = Bulkhead m port size 08 and s	y Standa Aerospa Standar AS4203 AS4216 ale port. smaller an	ards ce d d d	

### STANDARD PROCUREMENT SPECIFICATION FOR INTERNALLY SWAGED TO FLARELESS FITTINGS

SAE AS4459, Military MIL-F-18280 and Boeing BPS-F-125 specifications define Form, Fit, Function and Procurement requirements for Int-Swage to Flareless sleeves.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per necessary portions of AS4459, MIL-F-18280 and BPS-F-125 requirements. The fittings are approved for use in various military and commercial programs at Boeing, Interfast, Northrop/Grumman, Sikorsky, Tri-Star, Unirex, etc.

#### FITTING MATERIAL SELECTION

The fittings are made of Cres for use with various tubing materials, fluid and operating temperature.

#### MATERIAL AND CODING

Cres	Code	н	Indicates 15-5PH per AMS5659
CIES	COUE	11	Indicates 13-3FTT per AMS3039

#### COMPATIBILITY OF FITTING AND TUBING MATERIALS (Recommended tube wall per AS4459 and MIL-F-18280) (Fitting Material) (Tubing material)

Cres

Cres 21-6-9 per AMS5661 or, Cres 304 1/8Hd. per MIL-T-6845 or similar.

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING SIZE	TUBE O.D.	OPERATING PRESSURE (psi) PER FITTING MATERIAL Cres
04	1/4	3000
05	5/16	3000
06	3/8	3000
08	1/2	3000
10	5/8	3000
12	3/4	3000
14	7/8	3000
16	1	3000

#### TOOLING

Airdrome fittings are qualified and fully compatible to be swaged by Sierracin-Harrison or Ward & Garrison swage tooling. This will benefit Airdrome customers to receive our focus on quick fitting deliveries.

#### **EXAMPLE OF PART NUMBER FOR ORDERING INTERNALLY SWAGED TO FLARELESS FITTINGS**

AP2097H12 Size.

Material code (15-5 PH Cres)

Basic part number (Tube End Sleeve)

For fitting materials and sizes not listed, please contact Airdrome Parts Co.



Int-Swage to Flareless Sleeve					
	Port Seq	uence for			
Fitting Shape	Airdrome	Airdrome			
	(See Exampl	Standard			
	1	2			
Straight	M S		AP1004		
	F S		AP2097		
Note: 1. F = Female port. M = Male port.					

### METRIC BOSS SEPARABLE FITTING



#### **DESIGN CONCEPT:**

The concept of MA2012 Boss design provides an internally threaded port to mate with fittings for use in extreme tight areas. The design of the Boss accommodates mating with Straight threaded fitting end per MA2093. An O-ring that is installed on the hex face of the mating fitting end and compressed against the front seat of the Boss surface accomplishes sealing.

O-ring materials shall be selected based on compatibility with system fluid and temperature requirements. This design concept is handy for fluid connections on actuators, instrument gages, manifolds, pumps, reservoirs, etc. It is also an ideal fitting design for drainage purpose as well.

#### **DESIGN ADVANTAGES:**

- X Sealing efficiency is accomplished by changing new O-ring per each repeated usage. Thus, wear and tear of both mating fittings are kept to minimum to reduce down time and high repair cost.
- X Assembly of Boss connections can be made in place for production and repair applications.
- X Design concept allows fitting connections be installed in extreme tight areas.
- X Fittings are available in Cres, Titanium Alloy and Aluminum Alloy materials which are virtually compatible for use with just about any tube materials.
- **C** No special tooling is required except standard torque wrenches for fitting installation.

#### STANDARD PROCUREMENT SPECIFICATION FOR BOSS FITTINGS

SAE MA2005 or ISO7169 specifications define Form, Fit, Function and Procurement requirements for Boss fittings.

#### **APPROVAL STATUS**

Airdrome fittings are approved for use in various military and commercial programs at GTRE, HAL, Ilyushin, Kazan, P&W. etc.

#### FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with various tubing materials, fluid and operating temperature:

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928.
Cres	Code J	Indicates 304 per AMS-QQ-S-763.
	Code K	Indicates 316 per AMS-QQ-S-763.
	Code R	Indicates 321 per AMS-QQ-S-763.
	Code S	Indicates 347 per AMS-QQ-S-763.
Carbon steel	Code -	Indicates 4130 per MIL-S-6758 or 4140 per MIL-S-5626.
Aluminum Alloy	Code D	Indicates 2024-T6 or T851 per QQ-A-225/6 for bar/plate stock materials or 2014-T6 per QQ-A-367 for forging material.
	Code W	Indicates 7075-T73 per QQ-A-225/9 for bar/plate stock materials or per QQ-A-367 for forging material.

#### MATERIAL AND CODING

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING		OPERATING PRESSURE (kPa) PER FITTING MATERIAL			
SIZE	DN	Ti Alloy & Cres	Alum Alloy		
03	3.0	21000	21000		
04	4.0	21000	21000		
05	5.0	21000	21000		
06	6.0	21000	21000		
08	8.0	21000	21000		
10	10.0	21000	21000		
12	12.0	21000	21000		
14	14.0	21000	21000		
16	16.0	21000	21000		
18	18.0	21000	21000		
20	20.0	21000	21000		
25	25.0	21000	10500		
32	32.0	10500	10500		
40	40.0	10500	10500		

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**





#### METRIC FLARELESS SEPARABLE FITTING



#### **DESIGN CONCEPT:**

The concept of Flareless provides positive sealing and a high degree of sealing reliability for repeated usage. The configuration of Flareless joint consists an acorn shaped fitting nose designed to mate with a 24 degree cone fitting end forming a sealing point.

A gage diameter is provided on the acorn Flareless nose near the sealing diameter for installation reference and inspection purposes. The sealing point is located at the thicker wall area of both mating fitting ends to assure proper sealing with no dimensional movement through repeated usage.

A pilot end was added to the front nose of the acorn Flareless that fits inside the undercut of the 24 degree mating cone. This feature provides fitting alignment to effect positive sealing. In addition, a predetermined bottoming gap distance between mating fitting ends at the pilot nose and the shoulder is for preventing damage on the acorn Flareless nose by over torque on the nut.

Removal of the pilot end to make a shorter fitting is optional when fittings are used in tight areas or lighter weight is required. Either option is in use successfully in the industry.

Shape fittings such as elbow, tee or cross are available in a "Lightweight" version. It saves on an average of 30 % lighter weight than the Standard version.

#### **DESIGN ADVANTAGES:**

- X Sealing efficiency eliminates unnecessary down time and high repair cost.
- X Assembly of Flareless connections can be made in place for production and repair applications.
- X Design concept offers self-alignment to effect proper sealing. It offers bottoming feature to protect fitting from damage caused by nut over torque.
- X Fittings are available in Cres, Titanium Alloy and Aluminum Alloy materials which are virtually compatible for use with just about any tube materials.
- **C** No special tooling is required except standard torque wrenches for fitting installation.

# STANDARD PROCUREMENT SPECIFICATIONS FOR FLARELESS FITTINGS

SAE MA2005 or ISO7169 specifications define Form, Fit, Function and Procurement requirements for Flareless fittings.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per MA2005 and ISO7169 specifications. The fittings are approved for use in various military and commercial programs at GTRE, HAL, Ilyushin, Kazan, P&W, etc.

#### FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with various tubing materials, fluid and operating temperature:

#### MATERIAL AND CODING

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928.
Cres	Code J	Indicates 304 per AMS-QQ-S-763.
	Code K	Indicates 316 per AMS-QQ-S-763.
	Code R	Indicates 321 per AMS-QQ-S-763.
	Code S	Indicates 347 per AMS-QQ-S-763.
Carbon Steel	Code -	Indicates 4130 per MIL-S-6758 or 4140 per MIL-S-5626.
Aluminum Alloy	Code D	Indicates 2024-T6 or T851 per QQ-A-225/6 for bar/plate stock materials or 2014-T6 per QQ-A-367 for forging fittings.
	Code W	Indicates 7075-T73 per QQ-A-225/9 for bar/plate stock materials or per OO-A-367 for forging material.

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING		OPERATING PRESSURE (kPa) PER FITTING MATERIAL			
SIZE	DN	Ti Alloy	Cres	Alum Alloy	
05	5.0	28000	21000	21000	
06	6.0	28000	21000	21000	
08	8.0	28000	21000	21000	
10	10.0	28000	21000	21000	
12	12.0	28000	21000	21000	
14	14.0	28000	21000	21000	
16	16.0	28000	21000	21000	
20	20.0	28000	21000	21000	
25	25.0	28000	21000	10500	
32	32.0	28000	21000	10500	
40	40.0	28000	14000	10500	

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTING**



				1	1	1-
	AP51037	AP51032	AP51033	AP51038	AP51030	AP51156
		1	1 - 1 2	1	1	1 2
	AP51031	AP51152	AP51157	AP51159	AP51160	AP51208
	1 2	1	1	1	1	1
	AP51161	AP51314	AP51333	AP51313	AP51318	AP51320
				1 - <b>1</b>		1
	- AP51334	AP51332	AP51319	AP51335	AP51315	AP51566
	1	1 + + + + + + + + + + + + + + + + + + +	1	1	1 1 2 3 AP51561	1 - 2 - 2 - 3 AP51567
	1 2 			1 2 	1 2 3 AP51572	1
	$\begin{array}{c c} AP31363 \\ \hline \\ AP31363 \\ \hline \\ \\ 1 \\ \hline \\ + \\ 4 \\ \hline \\ 4 \\ 4$		AP51782	1 + 2 4 AP51778	1	1
						<b></b> 3
						1 2
	AP51786	AP51787	AP51788	AP51789	AP51790	AP51791

	Port Sequence for					-
Fitting Shape	e Airdrome Part No. only			only	Airdrome	Aerospace
	(See Example of Part No.)			Standard	Standard	
	1	2	3	4		
Jam Nut		-	-		AP51037	MA2118
					AP51032	MA2521
Coupling Nut					AP51033	MA2040
Sleeve	F				AP51038	MA2041
Can	F				AP51030	MA2036
Plug	M				AP51156	11/1/ (2000
i iug	M				AP51021	MA2025
Officiality					AF31031	IVIA2033
Straight	IVI	IVI			AP51152	IMA2115
						^MA2116
	М	М			AP51157	MA2025
						*MA2038
	F	F			AP51159	
	F	М			AP51160	
	В	М			AP51208	MA2043
						*MA2058
	В	F			AP51161	
45 deg Elbow	М	М			AP51314	
10 aog. 210011	F	F			AP51333	
	F	M			AP51313	MA2048
	N/				AD51313	MA2020
		D			AP51310	10172029
		В			AF51320	1110000
90 deg. Elbow		M			AP51334	MA2026
	F	F			AP51332	
	F	M			AP51319	MA2050
	M	В			AP51335	MA2030
	F	В			AP51315	
Tee	Μ	M	М		AP51566	MA2027
	F	F	F		AP51557	
	F	F	М		AP51562	
	М	M	F		AP51556	MA2051
	F	М	М		AP51559	MA2049
	М	F	F		AP51561	
	В	М	М		AP51567	MA2031
	М	В	F		AP51563	
	F	В	М		AP51564	
	F	В	F		AP51565	
	М	М	В		AP51553	MA2034
	F	М	В		AP51572	
	F	F	В		AP51573	
Cross	M	M	M	М	AP51780	MA2028
01033	101	141	141	IVI	*AD51777	10172020
	E	E	E	E	AD51792	
		F	1 <sup>-</sup>		AD51700	
		1 <sup>-</sup>			AD51702	
					AF31/18	
		IVI		IVI	AP51//9	MAGAEC
		M	M	IVI	AP51/81	MA2158
	F	В	M	M	AP51786	
	F	B	F	F	AP51787	
	М	B	F	F	AP51788	ļ
	F	В	F	М	AP51789	
	М	В	F	Μ	AP51790	
	М	М	М	В	AP51791	MA2157

## Metric 24 deg. Flareless Fittings and Equivalent Industry Standards

Notes: 1. F = Female Metric 24 deg. Flareless port, M = Male Metric 24 deg. Flareless port, B = Bulkhead Metric 24 deg. Flareless male port. 2. \* = A different part number assigned for reducers.


Fitting Shape	Po Airdı (See E	rt Sequ ome P xample	ience fo art No. e of Pa	Airdrome Standard	Aerospace Standard	
	1	2	3	4		
Straight	М	М			AP51209	MA2042
	F	М			AP51210	
	F	М			AP51211	MA2037
	F	F			AP51212	
	В	F			AP51213	
45 deg. Elbow	М	F			AP51321	
	F	F			AP51322	
	В	F			AP51323	
90 deg. Elbow	М	F			AP51324	
Ű	F	F			AP51336	
	В	F			AP51337	
Tee	М	F	М		AP51574	
	F	F	F		AP51575	
	М	F	F		AP51576	
	F	F	М		AP51577	
	М	М	F		AP51578	
	F	F	F		AP51579	
	F	М	F		AP51580	
	F	F	М		AP51581	
	F	F	F		AP51582	
	F	М	F		AP51583	
	F	F	F		AP51584	
	В	М	F		AP51585	MA2033
	F	В	F		AP51586	
	М	F	В		AP51587	
	В	F	М		AP51588	MA2032
	В	F	F		AP51589	
	F	F	В		AP51590	
	F	F	F B		AP51591	
	В	F	F		AP51592	
Cross	М	М	М	F	AP51792	
	F	F	F	F	AP51793	

#### Metric 24 deg. Flareless to Metric Boss Fittings and Equivalent Industry Standards

Note: 1. F = Female Metric 24 deg. Flareless or Metric Boss ports, M = Male Metric 24 deg. Flareless or Metric Boss ports,

B = Bulkhead Metric 24 deg. Flareless of Metric Boss pcB = Bulkhead Metric 24 deg. Flareless male port.

## METRIC DUAL SEPARABLE FITTING



## **DESIGN CONCEPT**

DualISeal is a registered trademark of a Dynamic Beam Seal fitting offers unique double sealing. The design of DualISeal fitting end has a circumferential beam with a wavy cross sectional profile. The elegant geometric of the beam will uniformly deflect against the mating fitting end creating two circular points of sealing.

At the beginning of nut torque, the primary seal is formed at the lower tangent point of the seal beam. Continuing to tighten the nut will form a secondary seal at the upper tangent point of the seal beam. The secondary seal provides another function as a stop (bottoming) preventing nut over torque to damaging the primary seal for repeated usage. The bottoming feature also provides stability of primary sealing at every DualISeal joints under vibration or bending conditions which are all critical requirements for flight conditions.

High strength materials are used for DualISeal fittings to achieve spring action for sealing force. When the seal beam is under deflection, the spring back force of the seal beam pushing on the mating fitting end creates a locking device for thread engagement. Upon disassembly, the elastic beam will spring back and will be ready for use again.

The contact surfaces (ie: mating fitting end and nut threads) are finished with dry film lubricant to assure ease of multiple repeated assemblies. As an option, dry film lubricant on mating fitting end can be exchanged for a bare metal surface with 8 micro smoothness for use in clean systems related to space programs.

#### **DESIGN ADVANTAGES:**

- A flush sealing face offers easy in place installation.
- Stronger material strength, smaller envelops and significantly lighter weight than Boss or Flareless (including LT-WT Flareless) fittings.

- Sealing efficiency eliminates unnecessary down time and high repair cost.
- Seals at lower nut torque than Boss or Flareless fittings.
- X Fittings are available in Cres and Titanium Alloy materials that are virtually compatible for use with just about any high strength tube materials.
- **C** No special tooling is required except standard torque wrenches for fitting installation.

#### STANDARD PROCUREMENT SPECIFICATIONS FOR DUAL/SEAL FITTINGS

AECMA EN3275 specification defines Form, Fit, Function and Procurement requirements for DualISeal fittings.

#### **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified per EN3275 specification. The fittings are approved for use in various space, military and commercial programs at Allison, GTRE, HAL, etc.

#### FITTING MATERIAL SELECTION

Fittings and nuts are offered in the following materials for use with various tubing materials, fluid and operating temperature:

#### MATERIAL AND CODING

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4965.
Cres	Code N Code P Code -	Indicates Inconel 718 per AMS5663. Indicates 17-4PH, H-1075 cond., per AMS5643 Indicates 21-6-9 per AMS5656.

#### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

FITTING		OPERATING PRESSURE (kPa) PER FITTING MATERIAL				
SIZE	DN	Ti Alloy	Cres			
04	4.0	28000	21000			
05	5.0	28000	21000			
06	6.0	28000	21000			
08	8.0	28000	21000			
10	10.0	28000	21000			
12	12.0	28000	21000			
14	14.0	28000	21000			

16	16.0	28000	21000
18	18.0	28000	21000
20	20.0	28000	21000
22	22.0	28000	21000
25	25.0	28000	21000
28	28.0	28000	21000
32	32.0	28000	21000
40	40.0	14000	14000

#### **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.

•	∄	- <del>[]</del> -	1 - [] →	1 -	1 -
AP50027	AP50004	AP50020	AP50392	AP50028	AP50390
1 - 2	1	1 - 2	12	1 - 2	1 2
AP50111	AP50158	AP50159	AP50112	AP50173	AP50167
1	1	1	1	1	
AP50344	AP50357	AP50353	AP50346	AP50356	AP50330
					1 - [] (†) [] 2 
AP50352	AP50335	AP50342	AP50348	AP50354	AP50502
1	1	1 2 2 	1 2 	1	12 2 3 AP50506
1	1 2 2 3 AP50512	12 3 AP50511	1 2 3 AP50513	1 2	1 - 2 3 AP50516
1 2 2 	1 - 2 - 2 	3 1 + 2 4 AP50776	3 1 1 2 4 AP50782	3 1	3 1 - 2 4 AP50777
3 1 2 4 AP50783	1 2 4 AP50779	1	3 1 1 2 4 AP50784	3 1	3 1 2 4 AP50786
3 1	3 1 4 AP50768				

Fitting Shape	Shape Port Sequence for Airdrome Part No. only (See Example of Part No.)		Airdrome	AECMA	Aerospace Standard		
	1 300 1	2	2	1(110.)	Stanuaru	Stanuaru	Stanuaru
Sool	1	2	5	4	A D50027	A DE0027	
Jam Nut					AP50027	EN3266	
Coupling Nut					AP50004	EN3265	MA2276
	F				AP503020	EN3265 & EN3260	WIA2270
Dust Cap	F				AP50022	EN0200 & EN0200	MA4248
Plug	M				AP50390	EN3268	101/11/12/10
Straight	M	М			AP50111	EN3244	MA2303
Otraight	101	101			A JUIT	*ENI3245	*MA2304
	F	F			AP50158	LINDZHO	1017 (2004
	F	M			AP50159		
	B	M			AP50112	EN3246	MA2305
	B	M			AP50173	EN3690	
	F	B			AP50167	2.10000	
45 deg Elbow	M	M			AP50344	EN3255	MA2289
io dog. Elbon	F	F			AP50357	2110200	110 12200
	F	M			AP50353		
	B	M			AP50346	EN3257	MA2292
	F	B			AP50356	2110207	110 12202
90 deg Elbow	M	M			AP50330	EN3249	MA2294
So deg. Libow	F	F			AP50352	LINDZHU	10172204
	F	M			AP50335	EN3250	
	B	M			AP50342	EN3253	MA2298
	B	M			AP50348	EN3692	10172230
	F	B			AP50354	LINGUGZ	
Τρρ	M	M	М		AP50502	EN3258	MA2284
100	101	101	101		AI 30302	*ENI3250	10172204
	F	F	F		AP50509	2110200	
	F	F	M		AP50510		
	M	M	F		AP50503	EN3260	
	F	M	M		AP50504	EN3261	
	M	F	F		AP50554	2110201	
	B	M	M		AP50506	EN3263	
	B	M	M		AP50507	EN3564	
	B	M	F		AP50512	LINGOUT	
	B	F	M		AP50511		
	B	F	F		AP50513		
	M	M	B		AP50505	EN3262	
	M	M	B		AP50516	EN3694	
	M	F	B		AP50514		
	F	F	B		AP50515		
Cross	М	М	М	М	AP50776	EN3565	
0.000	F	F	F	F	AP50782	2.10000	
	M	M	F	F	AP50778		
	M	F	F	F	AP50777		
	F	M	F	M	AP50783		
	F	M	M	M	AP50779		
	B	M	M	M	AP50780		
	F	F	F	В	AP50784		
	F	F	М	В	AP50785		
	М	М	F	В	AP50786		
	M	F	F	В	AP50787		
	М	F	М	В	AP50788		

Metric Dual Seal and Equivalent Industry Standards

Notes: 1. F = Female Metric Dual Seal port, M = Male Metric Dual Seal port,

B = Bulkhead Metric Dual Seal port.

2. \* = A different part number assigned for reducers.



	Po				
Fitting Shape	Ai	Airdrome			
	(See Example of Part No.)				Standard
	1	2	3	4	
Straight	Μ	Μ			AP50171
-	F	М			AP50175
	F	Μ			AP50176
	F	F			AP50177
	В	F			AP50178
	В	Μ			AP50179
45 deg. Elbow	М	F			AP50361
	F	F			AP50362
	В	F			AP50363
90 deg. Elbow	Μ	F			AP50364
-	F	F			AP50365
	В	F			AP50366
Тее	М	F	М		AP50592
	F	F	F		AP50593
	М	F	F		AP50594
	F	F	М		AP50595
	М	М	F		AP50596
	F	F	F		AP50597
	F	М	F		AP50598
	F	F	М		AP50599
	F	F	F		AP50600
	F	М	F		AP50601
	F	F	F		AP50602
	В	Μ	F		AP50603
	F	В	М		AP50604
	В	F	F		AP50605
	В	F	М		AP50606
	В	F	F		AP50607
	F	F	В		AP50608
	F	F	В		AP50609
	М	F	В		AP50610
Cross	М	Μ	Μ	F	AP50812
	F	F	F	F	AP50813

#### Metric Dual Seal to Boss Fittings

Note: 1. F = Female Metric Dual Seal or Metric Boss ports, M = Male Metric Dual Seal or Metric Boss ports,

B = Bulkhead Metric Dual Seal male port.

## METRIC ORBITAL WELD PERMANENT FITTING



## **DESIGN CONCEPT:**

Weld fitting design offers smallest envelope, lightest weight and strongest joint among all other mechanical fitting joints. Navy test results showed an average welded joint has a durable fatigue life up to 150 % higher than mechanically attached fitting joints. No wonder this concept is widely used in commercial and military programs worldwide.

The weld fitting end design has the simplest geometrical contour with an integral T-ring. It provides alignment for the fitting and tubing and is also a filler material for welding.

Fitting and tubing ends shall be cleaned prior to welding, one of the simplest cleaning methods is to spray acidtone to the weld joint and it will quickly evaporates.

Weld fittings are easily to be welded by Orbital weld tooling with electronic memories to reproduce accurate repeated weld each time. It minimizes X-ray inspection to a large degree. Different tooling is available for bench production weld or portable welding. The unified welded joint provides a positive fluid sealing.

#### **DESIGN ADVANTAGES:**

- X Unified weld joint offers positive sealing.
- X Offers smallest envelope, lightest weight and strongest fitting joint.

- X Electronic memories produce accurate repeated weld each time.
- X Weld tooling requires lowest maintenance cost by replacing tunston only.
- X Integral T-ring offers self-alignment for fitting and tubing butting to support proper welding.

# STANDARD PROCUREMENT SPECIFICATIONS FOR ORBITAL WELD FITTINGS

SAE MA2005, MA2060, MA2094, MA4510 and/or ISO7169 are applicable specifications define Form, Fit, Function and Procurement requirements for Orbital Tube Weld fittings.

#### QUALIFICATION AND APPROVAL STATUS

Airdrome fittings were qualified to meet necessary portions of MA2005, MA2060, MA2094, MA4510 and ISO7169 requirements. The fittings are approved for use in various space, military and commercial programs at Allison, GTRE, etc.

#### TOOLING

Various welding equipment manufacturers offer Orbital Weld tooling and training.

#### FITTING MATERIAL SELECTION

The Adapters or Permanent Orbital Tube Weld fittings are offered in the following applicable materials for use with various tubing materials, fluid and operating temperature:

Titanium Alloy	Code T	Indicates 6AL-4V per AMS4928 (all except DualISeal parts) and
		AMS4965 (for DualISeal parts only).
Cres	Code J	Indicates 304 per AMS-QQ-S-763 (all except DualISeal parts).
	Code K	Indicates 316 per AMS-QQ-S-763 (all except DualISeal parts).
	Code N	Indicates Inconel 718 per AMS5663.
	Code P	Indicates 17-4PH, H-1075 cond., per AMS5643.
	Code R	Indicates 321 per AMS-QQ-S-763 (all except DualISeal parts).
	Code S	Indicated 347 per AMS-QQ-S-763 (all except DualISeal parts).
	Code V	Indicates 15-5PH, H-1075 cond., per AMS5659.
	Code JL	Indicates 304L per AMS-QQ-S-763 (all except DualISeal part).
	Code KL	Indicates 316L per AMS-QQ-S-763 (all except DualISeal part).
	Code -	Indicates 21-6-9 per AMS5656.
Aluminum Alloy	Code D	Indicates 6061-T6 per QQ-A-225/8 (all but DualISeal part).

#### MATERIAL AND CODING

## SIZE, MATERIAL AND TUBE WALL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

		OTHI W	ER SEPARA ELD fittings	ABLE S	DUAL <b>IS</b> EAL SEPARABLE WELD fittings			
FITTING		OPERAT PER FI	ING PRES	SSURE (kPa) ATERIAL	OPERATING PRESSURE (kPa) PER FITTING MATERIAL			
SIZE	DN	Ti Alloy	Cres	Alum Alloy	Ti Alloy	Cres		
03	3.0	28000	21000	10500	28000	21000		
04	4.0	28000	21000	10500	28000	21000		
05	5.0	28000	21000	10500	28000	21000		
06	6.0	28000	21000	10500	28000	21000		
08	8.0	28000	21000	10500	28000	21000		
10	10.0	28000	21000	10500	28000	21000		
12	12.0	28000	21000	10500	28000	21000		
14	14.0	28000	21000	10500	28000	21000		
16	16.0	28000	21000	10500	28000	21000		
18	18.0	28000	21000	10500	28000	21000		
20	20.0	28000	21000	10500	28000	21000		
25	25.0	28000	21000	10500	28000	21000		
32	32.0	28000	21000	10500	28000	21000		
40	40.0	14000	14000	10500	14000	14000		

## **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.



Fitting Shape	Airdrome Part No.			Airdrome	AECMA	Aerospace	
	(See E	_xamp	e of Pa	art No.)	Standard	Standard	Standard
	1	2	3	4			
T-Ring	W				AP 52003	EN3688	MA2062
						EN3689	
Сар	W				AP 52004		
Straight	W	W			AP 52003		MA2066
45 deg. Elbow	W	W			AP 52346	EN3563	
90 deg. Elbow	W	W			AP 52329	EN3562	MA2069
Tee	W	W	W		AP 52553		MA2070
Cross	W	W	W	W	AP52776		MA2071

## Metric Orbital Tube Weld Fittings and Equivalent Industry Standards Port Sequence for

Notes: 1. W = Metric Orbital Tube Weld port.

2. The AP, EN and MA have the same configurations but are not interchangeable fittings.



Metric Orbital Tube Weld to Metric Boss Fittings

	Ρo	rt Sequ			
Fitting Shape	A irdrom e				
	(See E	Examp	le of Pa	art No.)	Standard
	1	2	3	4	
Straight	М	W			AP52105
	F	W			AP52106
45 deg. Elbow	F	W			AP52347
90 deg. Elbow	F	W			AP52348
Тее	F	W	W		AP52574
	F	W	F		AP52575
	F	F	W		AP52576
	W	W	F		AP52577
Cross	F	W	W	W	AP52777
	F	W	W	F	AP52778
	F	F	W	W	AP52779
	F	F	W	F	AP52780

Note: 1. F = Fem ale Metric Boss port,

M = Male Metric Boss port,

W = Metric Orbital Tube Weld port.



and Equivalent industry					Standards			
	Po	ort Sequ	uence f	or				
Fitting Shape	Airdr	ome Pa	art No.	only	Airdrome	AECMA	Aerospace	
	(See E	xample	e of Pa	rt No.)	Standard	Standard	Standard	
	1	2	3	4	i I			
Sleeve	F	W			AP50133	EN3243	MA2301	
0.0010	•				/ 00100	*EN3561		
Coupling Nut					A P50020	EN3265	MA2276	
Otasisht	-	14/			AD50474	L110203	10172270	
Straight	F	VV			AP50174			
	M	W			AP50131	EN3242	MA2300	
	В	W			AP50114	EN3247	MA2306	
	В	W			AP50180	EN3691		
45 deg. Elbow	F	W			AP30345	EN3256		
Ũ	М	W			AP50358			
	B	Ŵ			AP50359			
00 dag. Elbow	Б Г	14/			A DE0240	ENICOSO		
90 deg. Elbow	Г				AP50340	EN3232		
	IVI	VV			AP50341	EN3251		
	В	VV			AP50343	EN3254		
	В	W			AP50360	EN3693		
Tee	F	W	Μ		AP50573			
	М	W	М	l	AP50574			
	W	Ŵ	M		AP50575			
	M	\\/	101		A P50576			
		10/	VV \\\/		AP50570	-		
	_ Г	VV	VV		AP50577			
	F	F	VV		AP50578			
	F	W	F		AP50579			
	F	М	W		AP50580			
	Μ	W	F		AP50581			
	М	М	W		AP50582			
	W	W	F		AP50583			
	W	B	Ŵ		AP50584			
	F	B	\\/		A P50585			
		D	VV 		AF50585			
	VV	В	F		AP50586			
	M	В	VV		AP50587			
	W	В	M		AP50588			
	W	W	В		AP50589			
	F	W	В		AP50590			
	Μ	W	В		AP50591			
Cross	М	W	W	W	AP50789			
01000	M	M	Ŵ	W/	AP50790			
	IVI NA	N/	VV N4	VV \\\/	AP50790	-		
				VV	AP50791			
	F	VV	VV	VV	AP50792			
	F	F	W	W	AP50793			
	F	F	F	W	AP50794			
	F	Μ	W	W	AP50795			
	F	Μ	F	W	AP50796			
	F	М	М	W	AP50797			
	M	M	F	W	AP50798			
	F	E	M	10/	AP50700			
	I M	1	IVI	VV \\\/	AF 307 99			
	IVI	VV	IVI	VV	AP50800			
	M	VV	VV	F	AP50801			
	W	В	W	W	AP50802			
	М	В	W	W	AP50803			
	F	В	W	W	AP50804			
	М	В	М	W	AP50805			
	F	B	F	Ŵ	AP50806	-		
	F	B	M	\//	AP50807			
	Г М4	9		VV \\\/	AF 30007			
		D F		VV	AP50808			
	VV	В	IVI	IVI	AP50809			
	W	В	F	F	AP50810			
	W	В	M	F	AP50811			

## Metric Orbital Tube Weld to Metric Dual Seal Fittings and Equivalent Industry Standards

Notes: 1. F = Female Metric Dual Seal port,

M = Male Metric Dual Seal port,

B = Bulkhead Metric Dual Seal male port,

W = Metric Orbital Tube Weld port.
2. \* = A different part number assigned for reducers.

## METRIC EXTERNALLY SWAGED PERMANENT FITTING



#### **DESIGN CONCEPT**

The Externally Swaged fitting was originally developed by McDonnell Douglas (prior to become Boeing) who granted the manufacturing authority to Airdrome Precision Components. Another supplier gave the same fitting a tradename Permaswage.

After the patent was expired in 1991, Airdrome Precision Components improved the fitting design concept by lower the fitting yield strength slightly to increase significantly broader fitting application for use on softer tubing materials and/or thinner tube wall. It has also enhanced swaging tool life.

The unique geometric of the fitting design has a body and tail connected by a thinner wall mid section. It creates a flexible tail to absorb vibration and bending in flight conditions while static sealing takes place in the body section.

Externally Swaged fittings were designed for permanently assembled onto tubing by crimping with swaging tool. Each fitting offers 7.6 mm for tube insertion tolerance that minimizes pre-stress caused by stack-up tolerances during hydraulic line installation. This advantage can also be utilized by installing an union for repair of small tube defects less than 7.6 mm.

Fitting materials are available in Aluminum Alloy, Cres and Titanium for use with various tubing materials. Each fitting tail I.D. is coated with Teflon for lubrication to enhance stress relief on fitting joints under bending or vibration conditions. The Teflon finish is also colored differently for fitting material identification and surface protection purposes. Green Teflon is coated on inside and outside of Aluminum Alloy and inside of Cres fittings only, black Teflon is coated on inside and outside of Titanium fittings.

Each fitting end has two internal grooves for baked on silicone seal. Double silicone seal is required on Aluminum Alloy fittings for use on Aluminum Alloy tubing. Single silicone seal is sufficient on Cres and Titanium fittings for use on Cres and Titanium Alloy tubing. It is however, recommended that optional double silicone seal (to add suffix code Y in part number) should be used on all fittings.

## **DESIGN ADVANTAGES:**

- Sealing efficiency eliminates unnecessary down time and high repair cost.
- Large tube insertion tolerance minimizes pre-stress within hydraulic systems.
- Ext-Swage fittings are easy to install either in production or field repair.

## STANDARD PROCUREMENT SPECIFICATION FOR EXTERNALLY SWAGED FITTINGS

SAE MA2005 or ISO7169 specifications define Form, Fit, Function and Procurement requirements for Ext-Swage fittings.

## **QUALIFICATION AND APPROVAL STATUS**

Airdrome fittings were qualified to meet SAE MA2005 and ISO7169 specifications. The fittings are approved for use in various military and commercial programs at HAL.

## FITTING MATERIAL SELECTION

The Adapters and Permanent Ext-Swage fittings are offered in the following materials for use with various tubing materials, fluid and operating temperature:

Titanium	Code T	Indicates commercially pure Titanium per AMS4921.
Cres	Code -	Indicates 21-6-9 per AMS5656 not to exceed 65,000 psi yield strength.
Aluminum Alloy	Code D	Indicates 6061-T6 per QQ-A-225/8 except overaged to 23,000 and 33,000 psi yield strength.

#### MATERIAL AND CODING

#### COMPATIBILITY OF FITTING AND TUBING MATERIALS (Fitting Code) (Tubing material)

Т	Titanium Alloy 3AL-2.5V per AMS4944 or similar.
-	Titanium Alloy 3AL-2.5V per AMS4944 or, Cres 21-6-9 per AMS5561 or, Cres 304 1/8 Hard per MIL-T-6845 or, Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.
D	Aluminum Alloy 6061-T6 per MIL-T-7081 or similar.

#### TOOLING

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Deutsch D12xxx or DLT tooling designed for swaging fittings to meet as qualified fitting performance swages all fittings. Established Form, Fit and Function of all suppliers' fittings are fully defined and controlled by major worldwide OEM specifications.

### SIZE AND MATERIAL VERSUS OPERATING PRESSURE

Fitting/tubing operating pressures vary according to size and material. The following shows standard size range and corresponding operating pressures:

		OPERATING PRESSURE (kPa)					
SIZE	DN	Titanium & Cres	Alum Alloy				
04	4.0	28000	6900				
05	5.0	28000	6900				
06	6.0	28000	6900				
08	8.0	28000	6900				
10	10.0	28000	6900				
12	12.0	28000	6900				
14	14.0	28000	6900				
16	16.0	28000	6900				
18	18.0	28000	6900				
20	20.0	28000	6900				
22	22.0	28000	6900				
25	25.0	28000	6900				
28	28.0	28000	6900				
32	32.0	28000	6900				
40	40.0	14000	6900				

## **EXAMPLE OF PART NUMBER FOR ORDERING FITTINGS**



**Note:** Contact Airdrome Precision Components for special fitting configuration, material and/or size not listed in this catalog.



#### 28Mpa rated Metric Ext-Swage Fittings

Fitting Shape	Port Sequence for Airdrome Part No. (See Example of Part No.)				Airdrome Standard
	1	2	3	4	
Сар	S				AP 56101
Straight	S	S			AP 56100
	S	В			AP 56102
45 deg. Elbow	S	S			AP 56326
	В	S			AP 56337
90 deg. Elbow	S	S			AP 56325
	В	S			AP 56339
Tee	S	S	S		AP 56550
	В	S	S		AP 56574
	S	S	В		AP 56575
Cross	S	S	S	S	AP 56775
	В	S	S	S	AP 56777

Note: 1. S = Metric Ext-Swage port,

B = Metric Bulkhead Ext-Swage port.



Fittng Shape	Port Sequence for Airdrome Part No. (See Example of Part No.)		Airdrome Standard		
	1	2	3	4	
Coupling Nut					AP56000
Sleeve	F	S			AP56123-2
Straight	М	S			AP56110
	F	S			AP56123
	В	S			AP56105
45 deg. Elbow	М	S			AP56354
	F	S			AP56353
	В	S			AP56335
90 deg. Elbow	М	S			AP56329
	F	S			AP56327
	В	S			AP56331
Тее	М	S	S		AP56559
	S	S	М		AP56552
	М	S	М		AP56580
	М	М	S		AP56571
	F	S	S		AP56567
	S	S	F		AP56566
	F	S	F		AP56576
	F	F	S		AP56577
	М	S	F		AP56573
	F	S	М		AP56572
	М	F	S		AP56562
	S	В	S		AP56554
	В	S	М		AP56570
	М	В	S		AP56569
	В	S	F		AP56578
	F	В	S		AP56579
	S	S	В		AP56553
	М	S	В		AP56568
	F	S	В		AP56583
Cross	М	S	S	S	AP56778
	М	М	S	S	AP56779

## Adapters for 28 Mpa rated Metric Ext-Swage to Metric 24 deg. Flareless Fittings

Note: 1. F = Female Metric 24 deg. Flareless port,

M = Male Metric 24 deg. Flareless port, B = Bulkhead Metric 24 deg. Flareless port,

S = Metric Ext-Swage port.



Fitting Shape	Port Sequence for Airdrome Part No.			Airdrome	
		(See Example of Part No.)			Stanuaru
Straight	I NA	2	3	4	A DE7102
Straight		3			AP57103
	Г Р	0			AP57102
45 dag. Elhaur	Б	3			AP37101
45 deg. Elbow		3			AP57330
	Г	3			AP57329
00 dag. Elhavy		3			AP57333
90 deg. Elbow		3			AP57331
		S S			AP57332
<b>.</b>	В	5	0		AP57334
lee	M	S	S		AP57556
	S	S	M		AP57552
	M	S	M		AP57557
	M	M	S		AP57558
	F	S	S		AP57559
	S	S			AP57555
	F	S	F		AP57560
	F	F	S		AP57562
	М	S	F		AP57563
	F	S	М		AP57561
	М	F	S		AP57564
	В	S	S		AP57565
	В	S	М		AP57566
	М	В	S		AP57567
	В	S	F		AP57568
	F	В	S		AP57569
	S	S	В		AP57553
	М	S	В		AP57570
	F	S	В		AP57571
Cross	М	S	S	S	AP57775
	Μ	S	S	F	AP57776

Adapters for 28 Mpa rated Metric Ext-Swage to Metric Dual Seal Fittings

Note: 1. F = Female Metric Dual Seal port,

M = Male Metric Dual Seal port,

B = Metric Bulkhead Dual Seal port,

S = Metric Ext-Swage port.

## MAKE FROM SOLID<sup>TM</sup> TECHNOLOGY



## **DESIGN CONCEPT:**

Make From Solid<sup>TM</sup> (MFS<sup>TM</sup>) technology offers an alternate solution to manufacture products from a single piece of material thus eliminating the need for multiple fabrication steps required with weldments & castings.

Airdrome Precision Components & AF Aerospace developed MFS<sup>TM</sup> "building block connectors" to provide fluid conveyance design engineers with a cost effective capability to easily specify and apply elbows, straight tees, and hi-flow tees to their designs. These components are used in conjunction with custom and complex geometry MFS<sup>TM</sup> connectors as part of the overall fluid conveyance system design. They simplify the design of the fluid tubing/piping system resulting in reduced design time, weight, and cost. 1D bend radius components deliver size and space optimization without compromising product integrity. Various material options and end fitting configurations also support design flexibility. The fluid conveyance design engineer can easily follow the part number scheme described in this catalog to specify the configuration of the elbow, straight tee, or hi-flow tee connector required.

MFS<sup>TM</sup> system applications include:

- Fuel
- Air ducting
- Environmental Control Systems (ECS)
- Nitrogen Generating Systems (NGS)
- Water
- Engines
- Hydraulic

## **DESIGN ADVANTAGES:**

- Reduces weight
- Reduces or eliminates Welds
- Eliminates failures due to porosity
- Design optimization
- Reduces program development costs

- Reduces development, modification, and production lead times
- Reduces product life-cycle costs
- Delivers a consistent and controlled process to ensure manufacturing repeatability, precision, monitoring, documentation, and efficiency

## **QUALIFICATION AND APPROVAL STATUS**

The MFS<sup>TM</sup> products are approved for use in various space, military, and commercial programs at Airbus, Lockheed, Eaton, Smiths Tubular Systems, Rolls-Royce, etc.

## MFSTM MATERIAL SELECTION

The MFS<sup>TM</sup> products are offered in the following applicable materials for use with various tubing materials, fluid, and operating temperature:

Titanium Alloy	Code E	Indicates CP70, cond. A per AMS 4921.
	Code T	Indicates 6AL-4V annealed titanium alloy per AMS 4928
Cres	Code J	Indicates 304 per AMS-QQ-S-763 or AMS 5639.
	Code K	Indicates 316 per AMS-QQ-S-763 or AMS 5648.
	Code R	Indicates 321 per AMS-QQ-S-763 or AMS 5645.
	Code S	Indicates 347 per AMS-QQ-S-763 or AMS 5646.
	Code V	Indicates 15-5PH, H-1075 cond., per AMS5659.
	Code -	Indicates 21-6-9 per AMS5656.
Aluminum Alloy	Code A	Indicates 2219-T851 or –T87 per AMS-QQ-A-250/30 or AMS 4295
	Code D	Indicates 6061-T6, -T651, or -T6511 per AMS-QQ-A-200/8 or AMS-OO-A-225/8

#### MATERIAL AND CODING

The following are available end fitting styles for each port:



Note: Contact Airdrome Precision Components for special MFS<sup>TM</sup> end style configuration.

# EXAMPLE OF PART NUMBER FOR ORDERING MFSTM ELBOW CONNECTORS



Note: Contact Airdrome Precision Components for special MFS<sup>TM</sup> configuration, material and/or size not listed in this catalog.

The following are example of some configurations of AG105.



# EXAMPLE OF PART NUMBER FOR ORDERING MFSTM STRAIGHT TEE CONNECTORS





The following are example of some configurations of AG360.



# EXAMPLE OF PART NUMBER FOR ORDERING MFSTM HI-FLOW TEE CONNECTORS





The following are example of some configurations of AG361.

