

Equipment Compliance Certification and Inspection Solutions

**Focus on Safety C010 – ‘Irons’ with WECO hammer Unions**

**Swivels, Pup joints, Torque Valves, Integral joints**

What are they

- API Temporary pressure piping with quick connect WECO ‘Hammer Unions’
- Used for a variety of operations on the Rig from Kill lines to cementing



Types of Connections

- WECO Hammer Unions, Special connection type for temporary high-pressure piping
- Common Types on the Rigs: **2" FIG 1502 & 3" 1003**
- 1002 Has been phased out from the Oilfields in recent years
- **602 and 1502 potential mis-match! – see below**



**Weco Unions - Variations**

Series	Pressure Rating				Nominal Pipe Sizes
	Standard Service		Sour Gas Service		
	Working	Test	Working	Test	
100	1,000	1,500	NA	NA	2, 2½, 3, 4, 6, 8
200	2,000	3,000	NA	NA	1, 1½, 1¾, 2, 2½, 3, 4
206	2,000	3,000	NA	NA	1, 1½, 1¾, 2, 2½, 3, 4, 6, 8, 10
207	2,000	3,000	NA	NA	3, 4, 6, 8, 10
211	2,000	3,000	NA	NA	1, 1½, 1¾, 2, 2½, 3, 4
400	2,500	3,750	2,500	3,750	5, 6, 8, 10, 12
400	4,000	6,000	4,500	6,000	2, 2½, 3, 4
600	6,000	9,000	NA	NA	1, 1½, 2, 2½, 3, 4
602	6,000	9,000	6,000	9,000	1, 1½, 1¾, 2, 2½, 3, 4
1002	10,000	15,000	7,500	12,000	1, 1½, 1¾, 2, 2½, 3, 4, 5, 6
1003	10,000	15,000	7,500	12,000	2, 3, 4, 5
1502	15,000	22,500	10,000	15,000	1, 1½, 2, 2½, 3, 4
2002	20,000	30,000	NA	NA	2, 3
2202	NA	NA	15,000	22,500	2, 2½, 3

Equipment Standards

- Most equipment of this type is made (Material and welding) to API6A standards, even though this standard does not specifically mention the Weco Hammer Union or offer guidance on its inspection / maintenance schedule

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- As API6A is mentioned by OEM and the fact this equipment has a multi role it would be prudent to have a full Recertification by OEM every 5 years as per most Well control equipment. (Along with the regular comprehensive inspections and maintenance)
- ALWAYS REFER TO OEM – If OEM offers nothing then look to other OEMs like Weir / FMC

#### Compliance Requirements

- Critical and potentially lethal equipment which requires regular maintenance/inspection
- Must be cared for and stored without damaging critical threads
- **SWIM Sec36**
  - All Equipment should be tracked in the ‘Drilling equipment registry’
  - Annual Third party inspection (Third party qualifications?)
    - Visual, UTTG, Union, ID, Pressure test, Mushrooming
    - Full Material Trace-ability (COC)
- **API6A** – 5 Yearly Re-certification by API approved shop / OEM (If treated as well control – API Equipment)
- **API54** – Safety clamps and slings to be rated at a minimum of 1.5t with 5:1 FOS

**Inspection Procedures (if in use!)** – if equipment is stored and not used then good tracking and storage will prevent the need for unnecessary inspections.

- Close visual and strip down of critical elements
  - Remove the male union and fully inspect – NDT Suspect threads
  - Strip down the Swivel union, clean, inspect and rebuild with new hardware if required (OEM parts only) – Swivel union should move freely
  - Check for Mushrooming “Rolled over edges or metal fragments on hammer lugs shall be ground smooth. Care must be taken not to grind on the body of the nut. If the nut is found to be gouged or grooved from grinding it shall be removed from service and discarded. Wing and hammer lugs having 1/8” or less across the flat at the top of the hammer lug shall also be removed from service and discarded”
  - Wing nuts should be inspected using appropriate OEM gauge kit.
- UTTG (Thickness check)
  - Perform UT on critical areas – specific attention on corners / elbows (think of how the fluid flows within the pipe)
  - Review measurements and refer to OEM minimum thickness requirements for pressure required

#### Example of OEM nominal and minimum wall thickness based on 1502 piping with 10,000psi WP

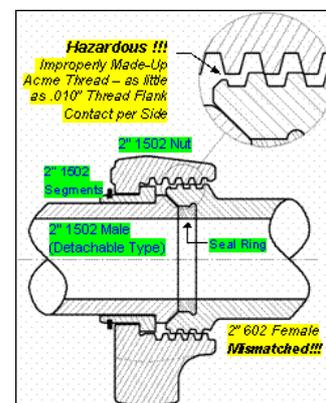
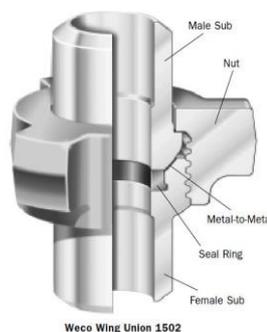
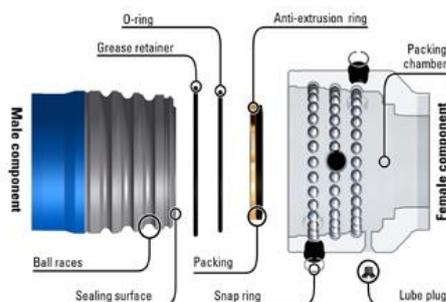
Pipe Nom size in.	Pipe OD	Pipe Sch	Material	Minimum design stress psi	H2S Standard	Nom wall thick in.	Min wall thick in.	Assigned WP psi (Working)	Assigned TP psi (Testing)
2	2.375	XXS	AISI 4130	48,000	Nace MR0175	0.436	0.254	10,000	15,000
3	3.500	XXS	AISI 4130	48,000	Nace MR0175	0.600	0.374	10,000	15,000
4	4.500	XXS	AISI 4130	48,000	Nace MR0175	0.674	0.481	10,000	15,000

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- Pressure test to equipment working pressure (Refer to OEM)
  - 1502 = 15,000psi (Unless specified as 10,000psi WP and marked as such)
  - Each item should be pressure tested individually

#### Common Issues

- Connection Mis-Match – Several incidents have occurred across the industry when the lower pressure ‘602’ female connection is paired with a ‘1502’ male Union – The 602 is slightly smaller, still fits well but cannot hold the pressure of the 1502.
- Failed union threads – Poor inspections that do not closely look at the threads of the unions which can crack at the base of the thread and fail under sudden pressure (there was a recent incident of this in Saudi 2018)
- No Trace-ability – Poor equipment tracking and ‘lazy’ inspections (A complete inspection looks at COCs and OEM Material documents) has led to many equipment of this type tagged with new serial numbers at every inspection – The OEM Band has been lost and no record or attempt by the contractor to track the equipment has led to huge numbers of equipment being ‘uncompliant’ with subsequent disposal being required at a huge cost to the contractor.
- Incomplete inspections – Every 6 months - year (Aramco SWIM and OEM) These equipment types should be subject to close visual, NDT and Pressure testing (See inspection procedures) Many of these inspections conducted at the rig site are not complete and do not fully inspect critical areas of the Unit – for example:
  - Threads not fully cleaned and inspected with MPI at base of threads (Female and Male)
  - Male Unions not removed and inspected fully (New spring retainer fitted if faulty)
  - Swivels not stripped and cleaned (We have found many swivels which are impossible to position by hand = Seized)
  - Thickness checks not made at critical positions and results not compared with OEM minimum requirements (very true for Many UTTG / critical measurement inspections)
  - Pressure tests only conducted to 5000psi – not sure why this has happened – maybe something to do with most Mud systems being 5000psi.
  - Items pressure tested in line (many items tested at once)



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Recent Inspection Report Highlighting the issues with Inspections and Auditing by personnel who are not competent with that equipment, Rig crew have no time to review Inspection certificates and do not have the knowledge on equipment compliance – the third is relied upon for this to remove non-compliant items from service, but if the third party has no idea and no one is auditing correctly – Audit will consist of does it have visual / NDT / PT certs – yes, all good... WRONG!

VISUAL, MPI, WALL THICKNESS & HYDROSTATIC TEST REPORT.

		<b>DATE OF INSPECTION</b>	9-Jan-18
		<b>INSPECTION DUE DATE</b>	8-Jan-19
		<b>MATERIAL SERIAL NO</b>	██████-EL-110
<b>MATERIAL DESCRIPTION</b>	ELBOW 90DEG 2"FIG 1502		
<b>TYPE OF INSPECTION</b>	VISUAL, MPI, UT & HYDROSTATIC TEST		
<b>LOW PRESSURE</b>	300 PSI HOLD FOR 3 MIN	Specification	
<b>HIGH PRESSURE</b>	5,000 PSI HOLD FOR 15 MIN	<input checked="" type="checkbox"/> Customer Spec.	
<b>WORKING PRESSURE</b>	5,000 PSI	<input checked="" type="checkbox"/> ASTM E-213	
		5,000 PSI	

Made up serial number with no trace-ability – this is VERY common

1502 fitting = 15000 psi  
Only tested to 5000psi

Equipment looks homemade (Where is COC?)

No Obvious Union or thread inspection (Still dirty)

MPI OK

Pressure test up to 5,000 Psi Accept

UT WALL THICKNESS			
A	0.175"	0.173"	0.170"
B	0.165"	0.162"	0.159"

Thickness shows the material is not within spec to cope with 1502 pressure

<b>Inspection Results / Comments</b>	No leakage was found During Hydrostatic Test on body & Conn. No surface defect or Crack Was found during inspection on body and hammer union.
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### Image of GOOD Storage for this critical Equipment: Notice the Thread protectors

Many Rigs store their 'Irons' in bins, threads exposed and damaged by the next item 'thrown' into the bin.. A Poor culture of care and maintenance that will need to be reversed to prevent a risk of incident.

