REFERANS ® METAL
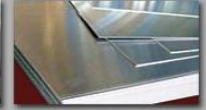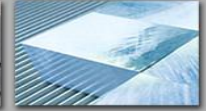

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
F	As Fabricated (no property limits specified)
O	Fully Annealed, Soft
H111	Some work hardening imparted by shaping processes but less than required for H11 temper
H112	Alloys that have some tempering from shaping but no special control over the amount of strainhardening or thermal treatment. Some strength limits apply.
H115	Armour Plate
H116	Special corrosion resistant temper

TEMPER	DESCRIPTION
H19	Work hardened to Extra Hard, not annealed after rolling
H24	Work hardened then partially annealed to half hard
H26	Work hardened then partially annealed to three-quarter hard
H28	Work hardened then partially annealed to fully hard
H32	Work hardened then stabilised by low-temperature heat treatment to quarter hard
H321	Strain hardened less than required for a controlled H32 temper.

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
H12	Work hardened to quarter hard, not annealed after rolling
H14	Work hardened to half hard, not annealed after rolling
H16	Work hardened to three-quarter hard, not annealed after rolling
H18	Work hardened to fully hard, not annealed after rolling
H38	Work hardened then stabilised by low-temperature heat treatment to fully hard

TEMPER	DESCRIPTION
H323	A version of H32 that has been specially fabricated to provide acceptable resistance to stress corrosion cracking
H34	Stabilised, Half Hard - A low temperature thermal treatment or heat introduced during manufacture which stabilises the mechanical properties.
H343	H34 specially fabricated to provide acceptable resistance to stress corrosion cracking.
H36	Work hardened then stabilised by low-temperature heat treatment to three-quarter hard
T351	Solution heat treatment and stress relieved by stretching. This is equivalent to -T4 condition. It applies to 2024 plate and rolled bar and 2219 plate per MIL-A-8920.

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
T1	Cooled from an elevated temperature shaping process and naturally aged to a substantially stable condition.
T2	Annealed (cast products only).
T3	Solution heat treated and then cold worked. Applies to products which are cold worked to improve strength or in which the effect of cold work in flattening or straightening is recognized in mechanical property limits.
T31	Solution heat treated and then cold worked by flattening or stretching. Applies to 2219 and 2024 sheet and plate per MIL-A-8920. Also applies to rivets driven cold immediately after solution heat treatment or cold storage. 2024 rivets are an example.

TEMPER	DESCRIPTION
T3511	Solution heat treated and stress relieved by stretching with minor stretching allowed.
T36	Solution heat treated and then cold worked by a reduction of 6 percent. Applies to 2024 sheet and plate.
T37	Solution heat treated and then cold worked by a reduction of 8 percent. Applies to 2219 sheet and plate.
T4	Solution heat treated and naturally aged to a substantially stable condition. Applies to products which are not cold worked after solution heat treatment, or in which the effect of cold work in flattening or straightening may not be recognized in mechanical property limits.

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
T42	Solution heat treated and naturally aged by the user to a substantially stable condition. Applies to 2014-0 and 2024-0 plate and extrusions which are heat treated by the user from the annealed condition.
T451	Solution heat treated and stress relieved by stretching. Equivalent to -T4 and applies to plate and rolled bar stock except 2024 and 2219.
T4511	Solution heat treated and stress relieved by stretching with minor straightening allowed. Equivalent to -T4 and applies to all extrusions except 2024 and 2219.

TEMPER	DESCRIPTION
T54	Cooled from an elevated temperature shaping process, stress-relived by stretching and compressing and then artificially aged. Applies to die forgings which are stress-relieved by restriking cold in the finish die.
T6	Solution heat treated and then artificially aged. Mechanical property limits not affected by cold working. Most alloys in the -w and -T4 conditions artificially aged to -T6.
T61	Solution heat treated and then artificially aged. Applies to forgings which receive a boiling water quench to avoid internal quenching stress. Applies to solution heat treated and artificially aged castings when more than one aging cycle is available for that alloy.

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
T5	Cooled from an elevated temperature shaping process and then artificially aged.
T51	Cooled from an elevated temperature shaping process, stress-relieved by stretching and then artificially aged.
T52	Cooled from an elevated temperature shaping process, stress-relieved by compressing and then artificially aged.
T62	Solution heat treated and then artificially aged by the user. Applies to any temper which has been heat treated and aged by user which attains mechanical properties different from those of the - T6 condition.
T651	Solution heat treated, stress- relieved by stretching and artificially aged. Equivalent to T6 and applies to plate and rolled bar except 2219.

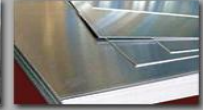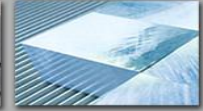| TEMPER	DESCRIPTION
T611	Solution heat treated and artificially aged. Applies only to 7079 forgings which are quenched in 1750 to 1850F water.
T6510	Solution heat treated, stress-relieved by stretching and artificially aged with no hard straightening after aging. Applies to extruded rod, bar and shapes except 2024.
T6511	Solution heat treated, stress-relieved by stretching and artificially aged with minor straightening.
T652	Solution heat treated, stress-relieved by compressive deformation and artificially aged.

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
T6511	Solution heat treated, stress-relieved by stretching and artificially aged with minor straightening. Equivalent to -T6 and applies to extruded rod, bar and shapes except 2024.
T652	Solution heat treated, stress-relieved by compressive deformation and artificially aged. Equivalent to -T6 and applies to hard forged squares, rectangles and simply shaped die forgings except 2219.
T7	Solution heat treated and then stabilized. Applies to products which are stabilized to carry them beyond the point of maximum strength to provide control of growth and residual stress.
T7352	Solution heat treated and specially artificially aged. Applies to 7075 alloy forgings which have both compression- stress relief and special aging to make the material resistant to stress-corrosion.

TEMPER	DESCRIPTION
T73	Solution heat treated and then specially artificially aged. Applies to 7075 alloys which have been specially aged to make the material resistant to stress-corrosion.
T7351	Solution heat treated and specially artificially aged. Applies to 7075 alloy sheet and plate which have been specially aged to make the material resistant to stress- corrosion.
T73511	Solution heat treatment and specially artificially aged. Applies to 7075 alloy extrusions which have been specially aged to make the material resistant to stress- corrosion.

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Temper Designations and Codes for Aluminum

TEMPER	DESCRIPTION
T8	Solution heat treated, cold worked and then artificially aged. Applies to products which are cold worked to improve strength, or in which the effect of cold work in flattening or straightening is recognized in the mechanical property limits.
T81	Solution heat treated, cold worked and then artificially aged. Applies to 2024-T3 artificially aged to T-81.
T851	Solution heat treated, stress-relieved by stretching and artificially aged. Applicable to plate, rolled bar and rod.
T8511	Solution heat treated, stress-relieved by stretching and artificially aged. Applies to 2024 extrusions and 2219.

TEMPER	DESCRIPTION
T86	Solution heat treated, cold worked by a thickness reduction of 6 percent and then artificially aged. Applies to 2024 sheet and plate.
T87	Solution -heat treated, cold worked by a thickness reduction of 10 percent and then artificially aged. Applies to 2219 sheet and plate.
T9	Solution heat treated, artificially aged and then cold worked. Applies to products which are cold worked to improve strength.
T10	Cooled from an elevated temperature shaping process, artificially aged and then cold worked.

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