Units Sharing the Same Dimensions

The following groups contain units that share identical **LT** dimensions (only groups with two or more units are listed):

- $\mathbf{L^{1}\,T^{-2}}$: Acceleration, Electric Field Strength, Galilei, Gravitational Field Strength
- $\mathbf{L^{-1}\,T^{1}}$: Ampere, Magnetomotive Force
- $\mathbf{L^{1}\,T^{1}}$: Angular Momentum, Magnetic Dipole Moment, Magnetic Moment, Planck's Constant
- $\mathbf{L^{0}\,T^{-1}}$: Angular Velocity, Hertz, Hubble Constant, Tesla
- $\mathbf{L^{2}\,T^{0}}$: Area, Compressibility
- $\mathbf{L^{-1}\,T^{0}}$: Attenuation Coefficient, Radiant Exposure, Surface Tension, Wave Number
- $\mathbf{L^{-2}\,T^{0}}$: Cosmological Constant, Energy Density, Negative Pressure, Pascal, Radiant Energy Density
- $\mathbf{L^{-1}\,T^{2}}$: Coulomb, Kilogram, Planck Mass
- $\mathbf{L^{4}\,T^{-4}}$: Coulomb Constant, Gravitational Constant
- $\mathbf{L^{-4}\,T^{2}}$: Density, Electric Charge Density
- $\mathbf{L^{-2}\,T^{1}}$: Dynamic Viscosity, Magnetic Field Strength
- $\mathbf{L^{3}\,T^{-2}}$: Electric Flux, Henry
- $\mathbf{L^{-3}\,T^{2}}$: Electric Flux Density, Magnetic Reluctance, Surface Density
- $\mathbf{L^{0}\,T^{1}}$: Electric Mobility, Impulse, Momentum, Planck Time, Second
- $\mathbf{L^{-1}\,T^{-1}}$: Heat Flux, Irradiance, Radiant Exitance, Radiosity
- $\mathbf{L^{1}\,T^{0}}$: Joule, Length, Moment of Force (Torque), Planck Energy, Planck Length, Radiant Energy
- $\mathbf{L^{2}\,T^{-1}}$: Kinematic Viscosity, Magnetic Flux, Weber
- $\mathbf{L^{0}\,T^{0}}$: Fine Structure Constant, Geomagnetic Ratio, Knudson Number, Newton, Radian, Reynolds Number, Steradian, Weber Number
- $\mathbf{L^{2}\,T^{-2}}$: Permeability, Specific Energy, Volt
- $\mathbf{L^{1}\,T^{-1}}$: Magnetic Rigidity, Magnetic Vector Potential, Radiant Flux, Radiant Intensity, Speed of Light in a Vacuum, Velocity, Watt

Units Sharing Inverse Dimensions

The following pairs of dimension groups contain units whose dimensions are inverses of each other (i.e., one group's dimensions are the negative exponents of the other's):

- $\mathbf{L^{1}\,T^{-2}}$ (Acceleration, Electric Field Strength, Galilei, Gravitational Field Strength) and $\mathbf{L^{-1}\,T^{2}}$ (Coulomb, Kilogram, Planck Mass)
- $\mathbf{L^{-1}\,T^{1}}$ (Ampere, Magnetomotive Force) and $\mathbf{L^{1}\,T^{-1}}$ (Magnetic Rigidity, Magnetic Vector Potential, Radiant Flux, Radiant Intensity, Speed of Light in a Vacuum, Velocity, Watt)
- $\mathbf{L^{1}\,T^{1}}$ (Angular Momentum, Magnetic Dipole Moment, Magnetic Moment, Planck's Constant) and $\mathbf{L^{-1}\,T^{-1}}$ (Heat Flux, Irradiance, Radiant Exitance, Radiosity)
- $\mathbf{L^{2}\,T^{0}}$ (Area, Compressibility) and $\mathbf{L^{-2}\,T^{0}}$ (Cosmological Constant, Energy Density, Negative Pressure, Pascal, Radiant Energy Density)
- $\mathbf{L^{-1}\,T^{0}}$ (Attenuation Coefficient, Radiant Exposure, Surface Tension, Wave Number) and $\mathbf{L^{1}\,T^{0}}$ (Joule, Length, Moment of Force (Torque), Planck Energy, Planck Length, Radiant Energy)
- $\mathbf{L^{-4}\,T^{3}}$ (Conductivity) and $\mathbf{L^{4}\,T^{-3}}$ (Resistivity)
- $\mathbf{L^{4}\,T^{-4}}$ (Coulomb Constant, Gravitational Constant) and $\mathbf{L^{-4}\,T^{4}}$ (Permittivity)
- $\mathbf{L^{-4}\,T^{2}}$ (Density, Electric Charge Density) and $\mathbf{L^{4}\,T^{-2}}$ (Specific Volume)
- $\mathbf{L^{-2}\,T^{1}}$ (Dynamic Viscosity, Magnetic Field Strength) and $\mathbf{L^{2}\,T^{-1}}$ (Kinematic Viscosity, Magnetic Flux, Weber)
- $\mathbf{L^{3}\,T^{-2}}$ (Electric Flux, Henry) and $\mathbf{L^{-3}\,T^{2}}$ (Electric Flux Density, Magnetic Reluctance, Surface Density)
- $\mathbf{L^{0}\,T^{1}}$ (Electric Mobility, Impulse, Momentum, Planck Time, Second) and $\mathbf{L^{0}\,T^{-1}}$ (Angular Velocity, Hertz, Hubble Constant, Tesla)
- $\mathbf{L^{-2}\,T^{2}}$ (Linear Charge Density) and $\mathbf{L^{2}\,T^{-2}}$ (Permeability, Specific Energy, Volt)
- $\mathbf{L^{3}\,T^{-3}}$ (Ohm) and $\mathbf{L^{-3}\,T^{3}}$ (Siemens)
- $\mathbf{L^{-3}\,T^{1}}$ (Current Density) and $\mathbf{L^{3}\,T^{-1}}$ (Volumetric Flow)

Units Mirrored Temporally and Spatially

The following pairs of dimension groups contain units whose dimensions are mirrors of each other (i.e., the exponents of **L** and **T** are swapped). This reflects a temporal-spatial symmetry, as in the example of Electric Field Strength ($\mathbf{L^{1}\,T^{-2}}$) and Magnetic Field Strength ($\mathbf{L^{-2}\,T^{1}}$):

- $\mathbf{L^1\ T^{-2}}$ (Acceleration, Electric Field Strength, Galilei, Gravitational Field Strength) and $\mathbf{L^{-2}\ T^1}$ (Dynamic Viscosity, Magnetic Field Strength)
- $\mathbf{L^{-1}\ T^1}$ (Ampere, Magnetomotive Force) and $\mathbf{L^1\ T^{-1}}$ (Magnetic Rigidity, Magnetic Vector Potential, Radiant Flux, Radiant Intensity, Speed of Light in a Vacuum, Velocity, Watt)
- $\mathbf{L^0\ T^{-2}}$ (Angular Acceleration) and $\mathbf{L^{-2}\ T^0}$ (Cosmological Constant, Energy Density, Negative Pressure, Pascal, Radiant Energy Density)
- $\mathbf{L^0\ T^{-1}}$ (Angular Velocity, Hertz, Hubble Constant, Tesla) and $\mathbf{L^{-1}\ T^0}$ (Attenuation Coefficient, Radiant Exposure, Surface Tension, Wave Number)
- $\mathbf{L^{-1}\ T^2}$ (Coulomb, Kilogram, Planck Mass) and $\mathbf{L^2\ T^{-1}}$ (Kinematic Viscosity, Magnetic Flux, Weber)
- $\mathbf{L^4\ T^{-4}}$ (Coulomb Constant, Gravitational Constant) and $\mathbf{L^{-4}\ T^4}$ (Permittivity)
- $\mathbf{L^1\ T^{-3}}$ (Jerk/Jolt) and $\mathbf{L^{-3}\ T^1}$ (Current Density)
- $\mathbf{L^0\ T^1}$ (Electric Mobility, Impulse, Momentum, Planck Time, Second) and $\mathbf{L^1\ T^0}$ (Joule, Length, Moment of Force (Torque), Planck Energy, Planck Length, Radiant Energy)
- $\mathbf{L^{-2}\ T^2}$ (Linear Charge Density) and $\mathbf{L^2\ T^{-2}}$ (Permeability, Specific Energy, Volt)
- $\mathbf{L^3\ T^{-3}}$ (Ohm) and $\mathbf{L^{-3}\ T^3}$ (Siemens)

Additionally, the following groups are self-mirrored (their dimensions remain the same when **L** and **T** exponents are swapped):

- $\mathbf{L^1\ T^1}$ (Angular Momentum, Magnetic Dipole Moment, Magnetic Moment, Planck's Constant)
- $\mathbf{L^{-1}\ T^{-1}}$ (Heat Flux, Irradiance, Radiant Exitance, Radiosity)
- $\mathbf{L^0\ T^0}$ (Fine Structure Constant, Geomagnetic Ratio, Knudson Number, Newton, Radian, Reynolds Number, Steradian, Weber Number)

Symmetries in Electromagnetism

- **Duality Between Electric and Magnetic Quantities**: A prominent pattern is the temporal-spatial mirroring (swapping **L** and **T** exponents), which highlights the electromagnetic duality in Maxwell's equations. For instance:
    - Electric Field Strength ($\mathbf{L^1\ T^{-2}}$) mirrors Magnetic Field Strength ($\mathbf{L^{-2}\ T^1}$), reflecting how electric fields relate to force per charge (acceleration-like) while magnetic fields relate to current loops or viscosity-like resistance in motion.

    - Electric Flux ($\mathbf{L^3\ T^{-2}}$) mirrors Electric Flux Density ($\mathbf{L^{-3}\ T^2}$), showing a volume vs. area density inversion.
    - This extends to constants like Permittivity ($\mathbf{L^{-4}\ T^4}$) and Coulomb Constant ($\mathbf{L^4\ T^{-4}}$), which are inverses, underscoring the reciprocal relationship in electrostatics ($\varepsilon_o \propto 1/k_e$).
- **Charge and Current Relations**: Charge-related units (Coulomb at $\mathbf{L^{-1}\ T^2}$) share dimensions with mass (Kilogram, Planck Mass), suggesting a conceptual link in this system where charge behaves mass-like. Current Density ($\mathbf{L^{-3}\ T^1}$) mirrors and inverts Volumetric Flow ($\mathbf{L^3\ T^{-1}}$), treating electric current as a "flow" analogous to fluid volume rate.
- **Conductance vs. Resistance**: Conductivity ($\mathbf{L^{-4}\ T^3}$) and Resistivity ($\mathbf{L^4\ T^{-3}}$) are perfect inverses, as are Siemens ($\mathbf{L^{-3}\ T^3}$) and Ohm ($\mathbf{L^3\ T^{-3}}$), illustrating the reciprocal nature of electrical transport properties.

Mechanical and Kinematic Patterns

- **Kinematic Hierarchy**: Units form a "derivative chain" based on time derivatives:
    - Position/Length ($\mathbf{L^1\ T^0}$) → Velocity ($\mathbf{L^1\ T^{-1}}$) → Acceleration ($\mathbf{L^1\ T^{-2}}$) → Jerk ($\mathbf{L^1\ T^{-3}}$).
    - This chain mirrors inversely with densities or resistances, e.g., Acceleration ($\mathbf{L^1\ T^{-2}}$) inverts to Coulomb/Kilogram ($\mathbf{L^{-1}\ T^2}$), and mirrors Dynamic Viscosity ($\mathbf{L^{-2}\ T^1}$), linking acceleration to frictional opposition.
- **Energy-Momentum Duality**: Energy units (Joule at $\mathbf{L^1\ T^0}$) share dimensions with Torque and Planck Energy, while Momentum/Impulse ($\mathbf{L^0\ T^1}$) shares dimensions with time-like units (Second, Planck Time). This pattern emphasizes conservation laws, where energy (**L**) is "spatial" and momentum (**T**) is "temporal" in this **LT** framework.
- **Density and Volume Reciprocals**: Density/Electric Charge Density ($\mathbf{L^{-4}\ T^2}$) inverts Specific Volume ($\mathbf{L^4\ T^{-2}}$), reflecting mass/charge per volume vs. volume per mass. Similarly, Area ($\mathbf{L^2\ T^0}$) inverts pressure-like units ($\mathbf{L^{-2}\ T^0}$, Pascal, Energy Density), showing surface vs. intensity patterns.

Thermodynamic and Flux Patterns

- **Flux and Intensity Inversions**: Flux quantities (Heat Flux, Irradiance at $\mathbf{L^{-1}\ T^{-1}}$) share dimensions and invert spatial quantities like Magnetic Vector Potential ($\mathbf{L^1\ T^{-1}}$). Radiant Flux/Power ($\mathbf{L^1\ T^{-1}}$, Watt) inverts heat-like fluxes, patterning energy transfer rates as reciprocal to density gradients.

- **Viscosity Kinds**: Dynamic Viscosity ($\mathbf{L^{-2}\,T^{1}}$) mirrors acceleration and inverts Kinematic Viscosity ($\mathbf{L^{2}\,T^{-1}}$), highlighting the role of density (which includes $\mathbf{T^{2}}$) in distinguishing momentum diffusion from sheer fluid flow.
- **Exposure vs. Density**: Radiant Exposure ($\mathbf{L^{-1}\,T^{0}}$) shares with attenuation-like units and inverts energy ($\mathbf{L^{1}\,T^{0}}$), patterning cumulative effects vs. instantaneous ones.

Fundamental Constants and Dimensionless Units

- **Universal Constants as Symmetries**: Gravitational Constant and Coulomb Constant both at $\mathbf{L^{4}\,T^{-4}}$ invert Permittivity ($\mathbf{L^{-4}\,T^{4}}$), suggesting a pattern of inverse-square laws unifying gravity and electromagnetism in this system. Planck's Constant ($\mathbf{L^{1}\,T^{1}}$) shares with angular/magnetic moments, linking quantum scales to classical rotations.
- **Dimensionless Clusters**: A large group at $\mathbf{L^{0}\,T^{0}}$ (Fine Structure Constant, Reynolds Number) patterns as ratios or pure numbers, often arising from balancing forces (inertia vs. viscosity) or fundamental couplings, immune to unit scaling.
- **Self-Mirrored Units**: Groups like $\mathbf{L^{1}\,T^{1}}$ (Angular Momentum) and $\mathbf{L^{-1}\,T^{-1}}$ (Heat Flux) remain unchanged under **L-T** swap, indicating intrinsic symmetries in conserved quantities or rates.

Overarching System Patterns

- **Force Dimensionlessness**: Newton at $\mathbf{L^{0}\,T^{0}}$ patterns many derived units as simplified, emphasizing this **LT** system's focus on spacetime over mass as primitive.
- **Inversion as Reciprocity**: Inverses dominate pairs like capacity (Permittivity) vs. stiffness (Constants), or bulk (Volume $\mathbf{L^{3}\,T^{0}}$) vs. density (Surface Density $\mathbf{L^{-3}\,T^{2}}$), reflecting physical reciprocals like compliance vs. modulus.
- **Mirroring as Duality**: Beyond electromagnetism, mirroring patterns temporal (**T**-dominant; time, momentum) vs. spatial (**L**-dominant; length, energy) aspects, with self-mirrors at the "balance point" (dimensionless or $\mathbf{L^{1}\,T^{1}}$).
- **Field-Specific Clustering**: Mechanics clusters around positive **L** (positions, energies), electromagnetism around mixed **L-T** with mirrors, while thermodynamics favors negative **L** (densities, fluxes), suggesting domain-specific dimensional biases.

These patterns reveal how the **LT** system unifies physics through spacetime primitives, exposing dualities (electric-magnetic) and reciprocities (conductance-resistance) that are less obvious in standard MLT analysis.