NICKEL IRON AND OTHER ALLOYS

Material	ρ	μ_0 d.c.	μ_{max} d.c.	(*B-H*) Sat. Gauss	(*B-H*) Sat. Lines/sq.in.
Mumetal	62	30 000	130 000	8 500	55 000
Permalloy C	60	16 000	75 000	8 000	52 000
Radiometal	55	2 200	22 000	16 000	103 000
Permalloy B	45	2 000	15 000	16 000	103 000
Permalloy A	20	12 000	90 000	11 000	71 000
Cr-Permalloy	65	12 000	60 000	8 000	52 000
Mo-Permalloy	55	20 000	75 000	8 500	55 000
1040	56	40 000	100 000	6 000	39 000
Megaperm	97	3 300	68 000	9 300	60 000
Hipernick	46	3 000	70 000	15 500	100 000
45 Permalloy	45	2 700	23 000	16 000	103 000
Rhometal*	95	250—2 000	1 200—8 500	12 000	78 000
4% Silicon Steel	55	450	8 000	19 500	125 000

ρ = resistivity in microhm cm ; μ_0 = initial permeability
μ_{max} = maximum permeability obtainable.

For audio transformer work the first four are frequently used. *RHOMETAL* has a special field of application, namely for transformers handling ultrasonic and radio frequencies up to several megacycles.

Flux densities of the order of 22 000 lines per square inch can be used with *MUMETAL* and approximately double this value with *RADIOMETAL*, the upper limit being set by the permissible distortion. For further information on this point see Sect. 3(iii).

For higher power **output transformers,** high silicon content (up to 4½%) sheet steel is in general use. To retain high permeability at low flux densities, the strips or laminations should be annealed after shearing and punching. Spiral cores of grain-oriented silicon steel are of considerable use in this application.

As a general rule, the output transformer should have the largest core which is practicable or permissible having regard to cost or other factors. A large core of ordinary silicon steel laminations is usually better than a small core of special low-loss steel.

The weight of steel in the core is a function of the minimum frequency, the permissible distortion, the core material, and the maximum power output. As a rough guide, subject to considerable variation in practice, the core may be taken as having

Weight in lbs. = 0.17 × watts output
Volume in cu. ins. = 0.7 × watts output.

These are for normal typical conditions, and may be decreased for less extended low frequency response or for a higher permissible distortion. For good fidelity, an increase in core size to double these values is desirable.

Several new **core materials** are now available including *CASLAM* and *FERROXCUBE.*

CASLAM is a soft magnetic core material with finely laminated structure for use at frequencies from 50 c/s up to at least 10 Kc/s. It is composed of flake iron particles pressed into a compact mass of the desired shape in such a way as to produce innumerable thin magnetic layers aligned in the plane of the flux. By virtue of its dense compacted structure many of the assembly and fixing problems associated with the older stacking method are eliminated. Grade 1 is a low density material with a maximum permeability of 860. Grade 2 is a denser material with a higher maximum permeability of 1000. Grade 3 is similar to grade 1 in magnetic characteristics but has better strength and machining qualities.

For choke cores a pair of E's can be butted together but where minimum gap is required the block can be broken and then rejoined after the coil is positioned. Because of the fibrous laminated structure exposed by breaking, microscopic interleaving occurs when the join is remade in the correct manner.

*Properties depend upon different heat treatment deliberately given.