

## Crystal-X™ – Soft Magnetic Powder Cores

### Summary

Arnold Magnetics has developed and is proud to release Crystal-X™ as a new addition to its soft magnetic powder core product line. Crystal-X™ alloy powder cores have low core loss and excellent DC bias characteristics, which contribute to highly efficient switching. Crystal-X™ also offers significant size & weight reduction compared with existing powder core materials such as MPP, High Flux™, Super-MSS™ and Iron-Silicon (Fe-Si)™. This size reduction is a direct result of higher material flux saturation density and lower volumetric losses.

Described as a “Holy Grail Material”, Crystal-X™ provides a never seen before combination of the low core loss characteristic of MPP and the exceptional flux saturation capability of High-Flux™.

### Material Property Comparison

Property	Crystal-X™	MPP	High- Flux™	Sendust™	Fe-Si™
Composition		Fe-Ni-Mo	Fe-Ni	Fe-Al-Si	Fe-Si
Bs	1.5 Tesla	0.75 Tesla	1.5 Tesla	1.0 Tesla	1.5 Tesla
Typical loss (mW/cm <sup>3</sup> ) at 100KHz 500G	140	120	260	200	300
DC Bias Yield for 50%u	115 Oe	100 Oe	120 Oe	90 Oe	115 Oe
Perm Value	14~60	14~350	14~160	14~147	14~90
Cost	Medium	High	Medium	Low	Low

### Benefits:

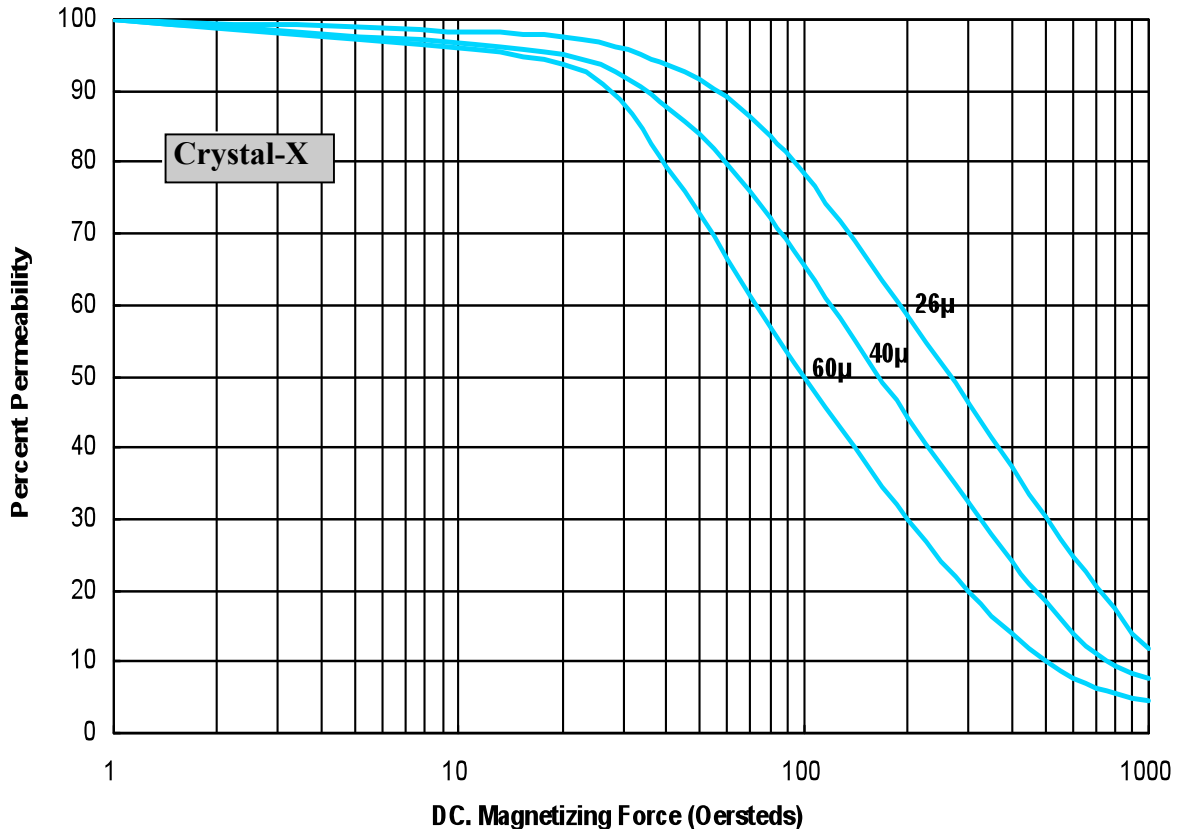
- Smaller Size.
- Lighter Weight.
- High Saturation Flux Density 15,000 Gauss (1.5Tesla).
- Excellent DC Bias.
- Lower core Loss (60μ: 300~400 mw/cc @ 0.1Tesla, 50 kHz).

### Applications:

- Switched Mode Powder supply
- Common Mode Chokes
- Telecom Interface Transformers and Signal Filters
- High Accuracy Current Transformers
- PFC chokes for Telecom, Networking and General Industrial applications.
- O/P chokes for Telecom and General Industrial applications.
- DC/DC converter chokes.

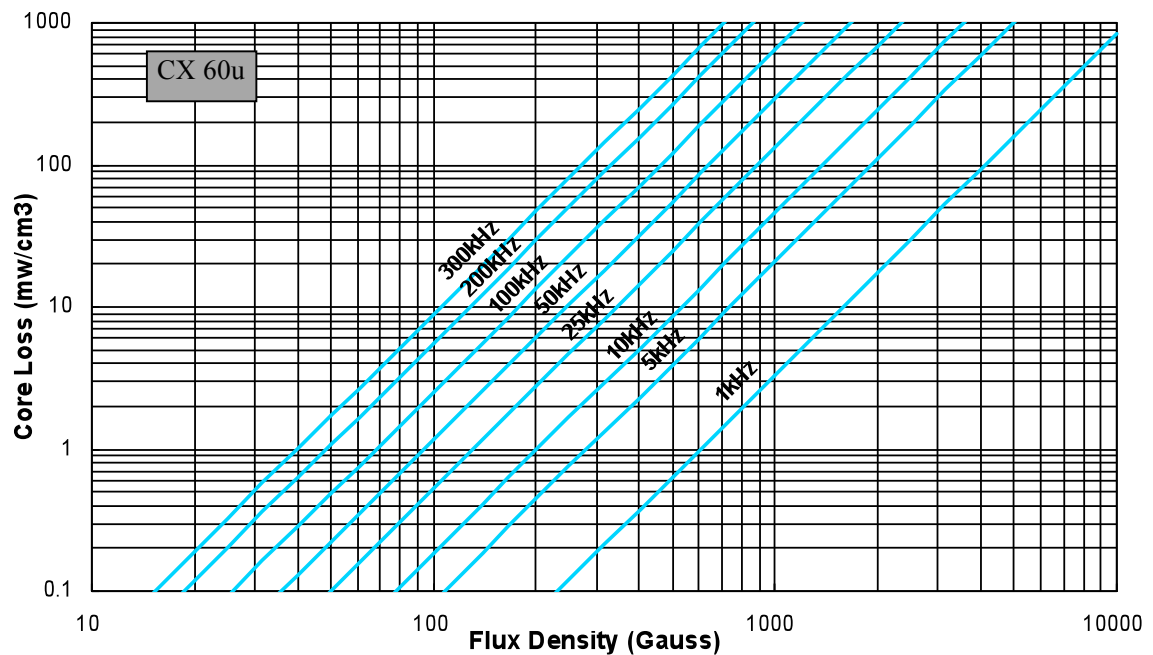
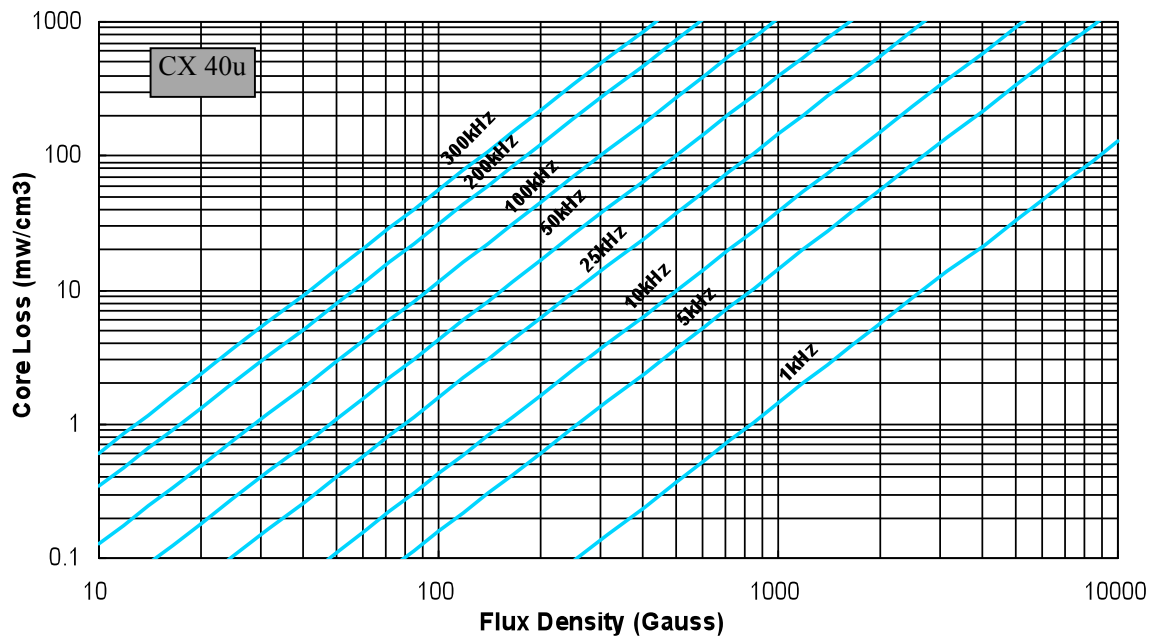
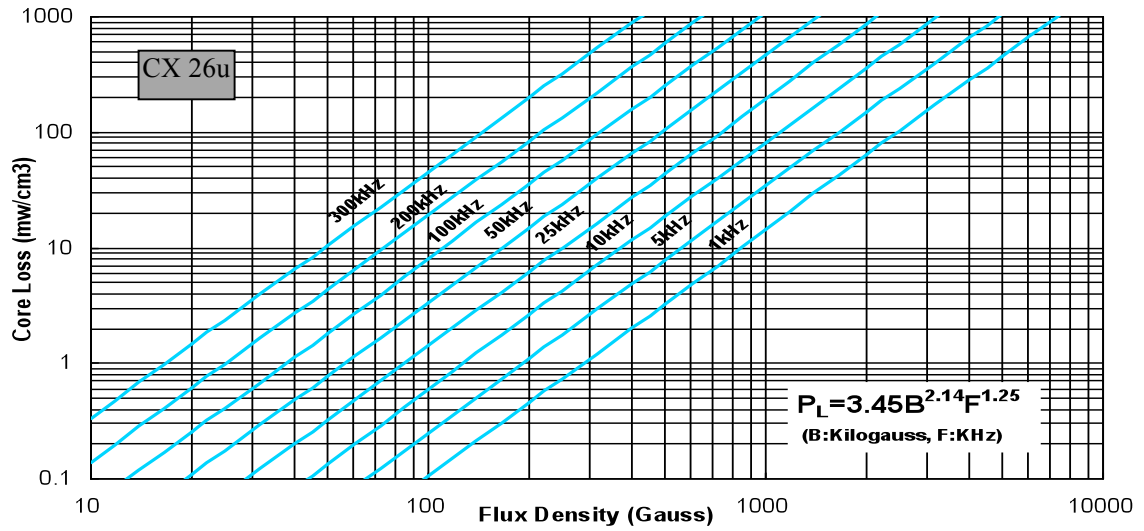
## Typical Incremental Permeability vs. D.C. Bias

The DC bias curves (below) demonstrate that the Crystal-X™ alloy powder core is excellent when compared with SMSS™ (Sendust) and MPP cores around 120 Oe and even can bear comparison with High-Flux™ and Fe-Si™ powder cores at 200 Oe and above on similar permeabilities and size. The curves presented here are measured based on standard 1.06 inch OD toroid core samples using a signal of 10 kHz and 100 mA AC.



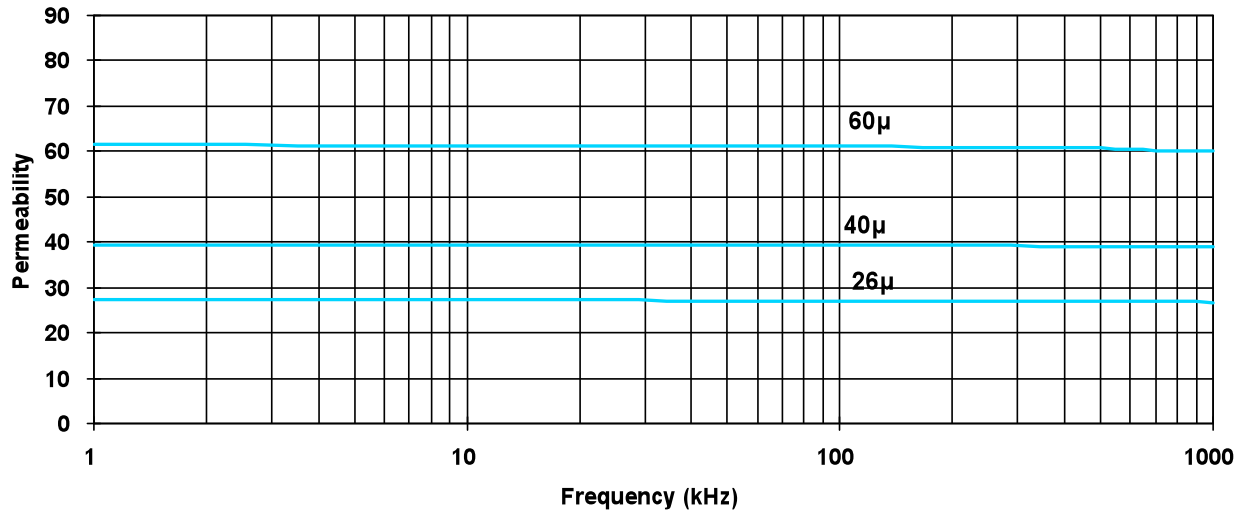
## Typical Core Loss Curves

The following Core loss curves demonstrate that Crystal-X™ alloy powder cores are excellent when compared with SMSS™ (Sendust), High-Flux™ and Fe-Si™ cores and close to MPP core loss performance on similar permeabilities and size. The curves presented here are measured based on standard 1.06 inch OD toroid cores.



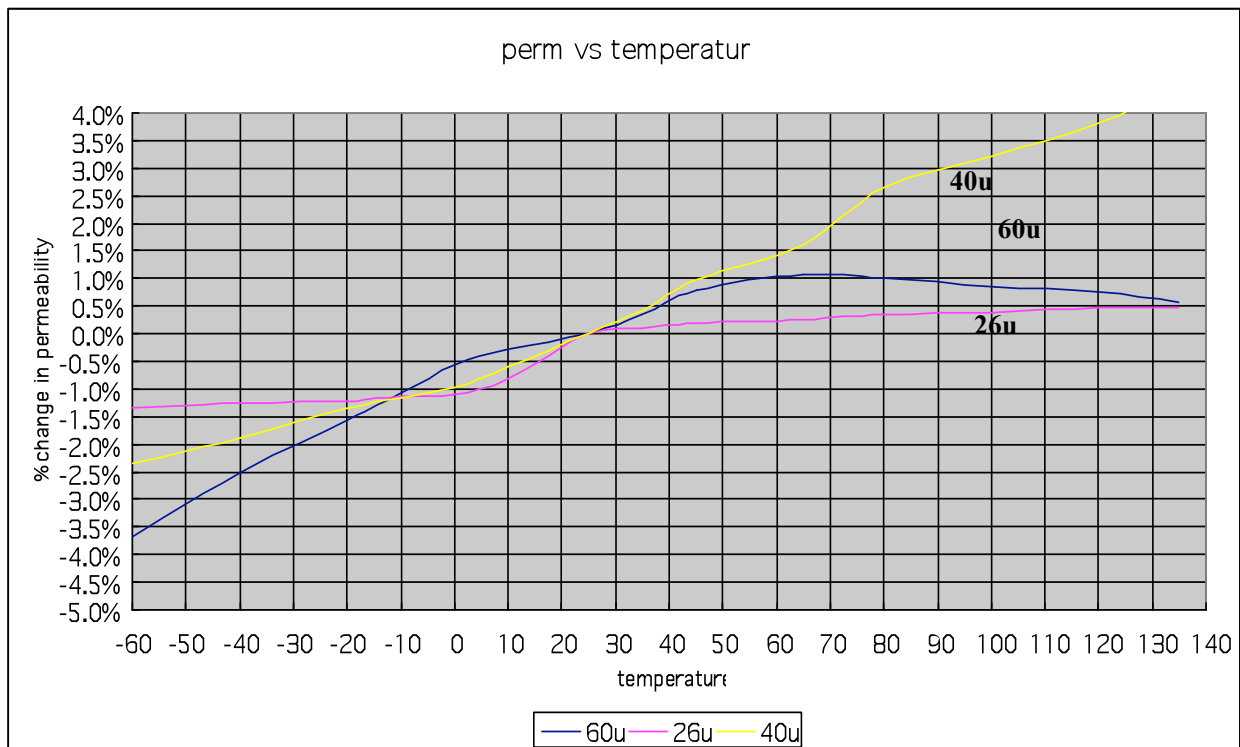
## Typical Permeability vs. Frequency

The inductance versus frequency graph demonstrates the near linear performance of Crystal-X™ powder cores to 1 MHz. Roll-off in permeability from low frequencies to 1 MHz is less than 2.0 percent !



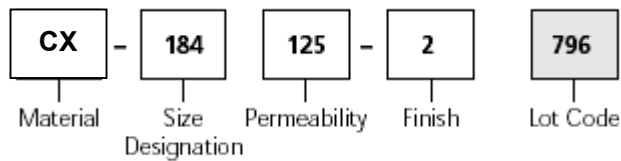
## Permeability versus Temperature

Arnold, Crystal-X™ alloy powder cores are stable in temperature compared to common ferrite cores and tape wound cores.



## Toroid Core Part Number Construction

Part numbers for Arnold Crystal-X™ cores are constructed as shown below.



**Crystal-X™ (CX) Toroidal Core Series Size table**

O.D.(inch)	I.D.(inch)	HGT(inch)	Radius(inch)	Area (cm <sup>2</sup> )	Lm (cm)	Volume (cm <sup>3</sup> )
0.140	0.070	0.060	0.008	0.0137	0.817	0.010746
0.155	0.087	0.100	0.008	0.0211	0.942	0.01967
0.183	0.093	0.100	0.008	0.0285	1.061	0.0302
0.250	0.110	0.110	0.016	0.0476	1.363	0.064219
0.260	0.105	0.100	0.016	0.0476	1.363	0.063971
0.260	0.105	0.180	0.016	0.088600	1.364	0.12086
0.260	0.105	0.188	0.016	0.092	1.363	0.1254
0.277	0.156	0.175	0.016	0.0669	1.682	0.1125
0.277	0.156	0.200	0.016	0.07497	1.682	0.126069
0.310	0.156	0.125	0.016	0.0615	1.787	0.1099
0.380	0.188	0.125	0.016	0.0752	2.177	0.1639
0.380	0.188	0.156	0.016	0.0945	2.177	0.206
0.400	0.200	0.097	0.008	0.061697	2.302	0.142026
0.400	0.200	0.156	0.016	0.1	2.38	0.238
0.440	0.250	0.156	0.016	0.0906	2.69	0.2437
0.500	0.300	0.187	0.031	0.114	3.124	0.35568
0.655	0.400	0.250	0.031	0.192	4.11	0.7891
0.680	0.380	0.250	0.031	0.232	4.14	0.9605
0.800	0.500	0.250	0.031	0.226	5.093	1.151
0.900	0.550	0.300	0.031	0.331	5.671	1.8771
0.928	0.567	0.350	0.031	0.388	5.88	2.2814
0.928	0.636	0.300	0.031	0.27726	6.1669	1.7098
1.060	0.580	0.340	0.063	0.49671	6.352	3.1551
1.060	0.580	0.440	0.063	0.654	6.352	4.154
1.300	0.785	0.345	0.063	0.55116	8.147	4.4902
1.300	0.785	0.420	0.063	0.672	8.147	5.4768
1.300	0.785	0.440	0.063	0.6981	8.147	5.687
1.350	0.920	0.350	0.063	0.454	8.948	4.0633
1.410	0.880	0.412	0.063	0.678	8.98	6.0884
1.570	0.950	0.570	0.094	1.072	9.848	10.5485
1.840	0.950	0.710	0.094	1.99	10.743	21.373
1.840	1.130	0.600	0.094	1.34	11.62	15.584
2.000	1.250	0.530	0.094	1.251	12.733	15.9296
2.250	1.039	0.600	0.094	2.2871	12.506	28.603
2.250	1.400	0.550	0.094	1.444	14.296	20.65
3.063	1.938	0.500	0.094	1.7729	19.612	34.77
3.063	1.938	0.625	0.094	2.2192	19.612	43.523
4.000	2.250	0.535	0.125	2.9716	24.271	72.122
4.000	2.250	0.650	0.125	3.5226	24.271	85.495
5.218	3.094	0.800	0.125	5.3471	33.12	173.4
5.218	3.094	1.000	0.125	6.71	32.429	217.58
5.218	3.715	0.998	0.015	4.835	35.302	170.686

Arnold Magnetics can supply a wide range of standard toroid O.D. sizes from 0.14 inch (3.6 mm) to 5.218 inch (133 mm), as with Arnold MPP, High-Flux™, Super-MSS™ and Fe-Si™ core series. Arnold is also capable of providing non-standard, customer-specified physical dimensions.



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