

CONTENTS

Foreword	xix
Dedication.....	xx
Samuel C. Collins Award.....	xxi
Russell B. Scott, Memorial Awards	xxiii
Student Awards.....	xxiv
1993 Cryogenic Engineering Conference Board.....	xxv
Acknowledgments.....	xxvi

PART A

Transportation Applications

STATUS OF MAGLEV: OPPORTUNITIES IN CRYOGENICS AND SUPERCONDUCTIVITY..	1
H. Coffey	
PERSISTENT CURRENT DECAY OF A SUPERCONDUCTING COIL IN AN AC FIELD.....	17
S. Jeong, J.V. Minervini, J.R. Hale and Y.J. Chen	
MAGLEV COOLING OPTIONS FOR Nb ₃ Sn CABLES IN CONDUIT SUPERCONDUCTING MAGNETS.....	25
R.C. Longsworth	
HYDROGEN CRYOFUEL IN INTERNAL COMBUSTION ENGINES.....	35
W. Peschka	
ECONOMICS OF LIQUEFIED NATURAL GAS PRODUCTION, TRANSPORT AND DISTRIBUTION FOR END USE AS A TRANSPORTATION FUEL.....	45
R.E. Adkins and H.E. Sutton	
DEVELOPMENT OF A SIMPLE 5-15 LITRE PER HOUR LNG REFUELING SYSTEM.....	55
A.J. Corless, S.K. Sarangi, J.L. Hall and J.A. Barclay	

Wind Tunnels

CRYOGENIC WIND TUNNELS - A BRIEF REVIEW	63
R.A. Kilgore	
THE T2 CRYOGENIC TRANSONIC WIND TUNNEL OF ONERA-CERT TOULOUSE FRANCE	71
A. Mignosi, J.P. Archambaud, A. Seraudie and J.B. Dor	
THE DESIGN AND OPERATING EXPERIENCE OF THE NDA CRYOGENIC WIND TUNNEL	79
Y. Yamaguchi, T. Sakaue, M. Yorozu, T. Saito and S. Wada	
CRYOGENIC TUNNEL ACTIVITIES AT THE UNIVERSITY OF TSUKUBA	89
T. Adachi	
EFFECTS OF WATER VAPOR ON CRYOGENIC WIND TUNNELS.....	99
W.A. Kilgore and S. Balakrishna	
STRUCTURAL COOLDOWN ENERGY OPTIMIZATION FOR CRYOGENIC WIND TUNNELS.....	107
S. Balakrishna and W.A. Kilgore	

Space Applications

LIQUID/GAS PHASE SEPARATORS FOR THE SUPERFLUID HELIUM ON-ORBIT TRANSFER (SHOOT) PROJECT.....	121
J.G. Tuttle, M.J. Dipirro and P.J. Shirron	
MASS GAUGING AND THERMOMETRY ON THE SUPERFLUID HELIUM ON-ORBIT TRANSFER FLIGHT DEMONSTRATION	129
M.J. Dipirro, P.J. Shirron and J.G. Tuttle	
THE LAMBDA-POINT EXPERIMENT: HELIUM CRYOSTAT, CRYO-SERVICING, FUNCTIONS, AND PERFORMANCE.....	137
D. Petrac, U.E. Israelsson and T.S. Luchik	
DEMONSTRATION OF NO-VENT FILL AND SOLIDIFICATION OF NITROGEN FOR THE NICMOS DEWAR.....	145
C. Miller	
COMPARISON OF LIQUID HYDROGEN NO-VENT FILL TEST DATA WITH ANALYTIC MODELS	153
S.C. Honkonen and D.J. Chato	
PRODUCTION OF ULTRALOW MAGNETIC FIELDS FOR GRAVITY PROBE B (GP-B).....	161
M.A. Taber, D.O. Murray, J.M. Lockhart, D.J. Frank and D. Donegan	
WEIGHT REDUCTION APPROACHES FOR HELIUM FLIGHT DEWARS	171
T.E Abrahamson, M.S. Jacoby, R. Parmley and L. Sokolsky	
VARIOUS MAGNET OPTIONS FOR A DELTA LAUNCHED VERSION OF ASTROMAG.....	179
M.A. Green	
THE NEW X-RAY SPECTROMETER (XRS)--A REVAMPED CRYOGENIC INSTRUMENT FOR THE RESTRUCTURED AXAF-S MISSION.....	187
S.R. Breon and R.A. Hopkins	
CRATE: A SUPERFLUID HELIUM DEWAR FOR A SMALL EXPLORER (SMEX) SATELLITE.....	193
S.M. Volz	
LIQUID HYDROGEN MICROGRAVITY FLIGHT EXPERIMENT CONCEPT	201
M.W. Liggett and G.R. Karr	
THE CONTROL OF LIQUID HELIUM IN SPACE BY ELECTROSTATICS FOR THE SATELLITE TEST OF EQUIVALENCE PRINCIPLE EXPERIMENT.....	209
P.V. Mason, D.M. Strayer, D. Petrac, G. Gutt, K. Warfield, P. Worden and R. Torii	
CRYOGENIC LIQUID HYDROGEN SUCTION DIP AND SLOSH WAVE EXCITATION DURING DRAINING IN MICROGRAVITY	219
R.J. Hung and K.L Shyu	
CRYOGENIC HELIUM SYSTEM ANGULAR MOMENTUM AND MOMENT FLUCTUATIONS DRIVEN BY GRAVITY GRADIENT IN MICROGRAVITY.....	231
R.J. Hung and H.L. Pan	
GRAVITY GRADIENT INDUCED VISCOS STRESS AND MOMENT FLUCTUATIONS OF CRYOGENIC HELIUM SYSTEM IN MICROGRAVITY.....	241
R.J. Hung and H.L. Pan	
EFFECT OF THE BAFFLE ON THE CRYOGENIC HELIUM CONTAINER VISCOS STRESS AND MOMENT FLUCTUATIONS IN MICROGRAVITY	251
R.J. Hung and C.C. Lee	
EFFECT OF THE BAFFLE ON THE CRYOGENIC HELIUM CONTAINER ANGULAR MOMENTUM AND MOMENT FLUCTUATIONS DUE TO ASYMMETRIC GRAVITY JITTER EXCITED SLOSH WAVES.....	261
R.J. Hung and C.C. Lee	
Magnet: Design and Performance	
ESTIMATING THE COST OF LARGE SUPERCONDUCTING THIN SOLENOID MAGNETS..	271
M.A. Green and S.J. St.Lorant	

A SUMMARY OF THE QUENCH BEHAVIOR OF B&W 1M COLLIDER QUADRUPOLE MODEL MAGNETS	277
C.M. Rey, M. Xu, P. Hlasniecek, J.P. Kelley, K.D. Dixon, J. Savignano, S. Letterman, P. Craig, J.E. Maloney, D.W. Boyes, M. Shrader and B.I. Cantor	
A COMPARISON OF FORCE-REDUCED TOROIDAL GEOMETRIES AND CONVENTIONAL SUPERCONDUCTING MAGNETS.....	285
J.L. Hill, B.C. Amm and J. Schwartz	
EXCITATION CHARACTERISTICS OF SUPERCONDUCTING MAGNET WOUND WITH PARALLEL CONDUCTORS.....	293
W. Yoo, O. Tsukamoto and N. Amemiya	
DESIGN OF THE 2 TESLA SUPERCONDUCTING SOLENOID FOR THE FERMILAB D0 DETECTOR UPGRADE	301
B. Squires, J. Brzezniak, R.W. Fast, K.J. Krempetz, A. Kristalinski, A. Lee, D. Markley, A. Mesin, S. Orr, R.A. Rucinski, S. Sakla, R.L. Schmitt, R.P. Smith, R.P. Stanek, A.M. Stefanik, A. Visser, R.H. Wands and R. Yamada	
STRUCTURAL ANALYSIS OF THE LARGE HELICAL DEVICE	309
S. Imagawa, H. Hayashi, H. Tamura, A. Nishimura, T. Satow, J. Yamamoto, O. Motojima and the LHD Group	
PERSISTENT MODE SUPERCONDUCTING MAGNET WITH DEMOUNTABLE LEADS	317
R.C. Whitestone and G.F. Green	
HEAT LEAK TESTING OF A SUPERCONDUCTING RHIC DIPOLE MAGNET AT BROOKHAVEN NATIONAL LABORATORY.....	325
J.T. DeLallo, D.P. Brown and J. Sondericker	
THE SECOND TEST RESULT ON THE Nb ₃ Sn DEMO POLOIDAL COIL (DPC-EX)	335
T. Ando, H. Nakajima, T. Sasaki, T. Hiyama, Y. Takahashi, M. Nishi, K. Yoshida, K. Okuno, T. Kato, M. Sugimoto, T. Isono, K. Kawano, N. Koizumi, K. Hamada, M. Oshikiri, T. Sasaki, Y. Wadayama, A. Miyake, S. Iwamoto, T. Takahashi, H. Ebisu, T. Hosono, K. Yamamoto, Y. Yasukawa, H. Tsukamoto, H. Hanawa, S. Seki, H. Wakabayashi, H. Tsuji, M. Takayasu, B. Turck and F. Wuchuner	
A 7.7 T NbTi SUPERCONDUCTING MAGNET SYSTEM COOLED BY A 4 K GM REFRIGERATOR.....	343
M. Takahashi, R. Hakamada, K. Yamamoto, T. Kuriyama, H. Nakagome, S. Masuyama, H. Yamamoto, S. Tanaka and Y. Matsubara	
DESIGN OF AN ACTIVE SHIELD DIPOLE MAGNET IN THE INTERACTION REGION OF THE KEK B-FACTORY.....	351
K. Tsuchiya, T.M. Kobayashi, T. Haruyama, Y. Ajima, Y. Doi, N. Ohuchi, S. Kurokawa and A. Kimura	

Magnet: Cooling

THERMAL CHARACTERISTICS OF THE MAGCOOL CRYOGENIC SYSTEM AFTER QUENCHES OF RHIC DIPOLES.....	359
K.C. Wu	
DEVELOPMENT OF THE CRYOSTAT FOR THE HIGH FIELD MAGNET SYSTEM.....	367
M. Taneda, S. Ito, T. Miki, T. Kamikado, Y. Murakami, K. Matumoto, K. Shibutani, R. Ogawa and Y. Kawate	
CRYOGENIC SYSTEM FOR THE 45 TESLA HYBRID MAGNET	375
S.W. Van Sciver, J.R. Miller, S. Welton, H.J. Schneider-Muntau and G.E. McIntosh	
CRYOGENICS IN CEBAF HMS DIPOLE	381
P. Bogensberger, P. Brindza, H. Köfler, F. Ramsauer and R. Wines	
A LIQUID HELIUM CRYOGENIC SYSTEM DESIGN FOR THE GEM MAGNET.....	389
G. Deis, R.P. Warren, D. Richied, N.N. Martovetsky, J. Krupczak, A. Sidi-Yekhlef, J.R. Pace and C. Collins	
THERMAL CONTACT CONDUCTANCE AND THERMAL SHIELD DESIGN FOR SUPERCONDUCTING MAGNET SYSTEMS.....	397
M.J. Nilles and G.A. Lehmann	

Magnet: Technology and Applications

THE NATIONAL HIGH MAGNETIC FIELD LABORATORY, A USER FACILITY IN SUPPORT OF RESEARCH IN HIGH MAGNETIC FIELDS.....	403
J.E. Crow, D. Parkin, H.J. Schneider-Muntau and N. Sullivan	
LOW TEMPERATURE HIGH MAGNETIC FIELD ACTIVITIES AT THE FRANCIS BITTER NATIONAL MAGNET LABORATORY	411
L.G. Rubin, S.J. Klepper, E.J. McNiff, Jr and T. Vu	
PRESENT STATUS OF THE HIGH-FIELD RESEARCH CENTER AT THE NATIONAL RESEARCH INSTITUTE FOR METALS, JAPAN.....	419
K. Inoue, T. Kiyoshi, T. Asano, Y. Sakai, T. Takeuchi, K. Itoh, M. Oshikiri, H. Wada and H. Maeda	
STABILITY OF AN UNCOOLED SEGMENT OF A HIGH-TEMPERATURE SUPERCONDUCTOR	429
L. Dresner	
NORMAL ZONE PROPAGATION AND THERMAL HYDRAULIC QUENCHBACK IN A CABLE-IN-CONDUIT SUPERCONDUCTOR.....	437
J.W. Lue and L. Dresner	
INFLUENCE OF CONDUCTOR GEOMETRY ON NORMAL-ZONE PROPAGATION VELOCITIES IN NbTi/CuNi COMPOSITE SUPERCONDUCTORS	445
M. Tsuda, Y. Takada, T. Shimada, A. Ishiyama and H. Fuji	
INVESTIGATIONS ON THE STABILITY OF HTSC USED TO HIGH MAGNETIC FIELDS AT 4.2K AND 77K.....	453
L.Y. Xiao, S. Han and L.Z. Lin	
HIGH ENERGY BOOSTER DIPOLE MAGNET (HDM) QUENCH HEATER DESIGN AND PROJECTED PERFORMANCE	461
O.R. Christianson, T.J. Fagan and J.F. Roach	
TEVATRON QUENCH PRESSURE MEASUREMENT	469
J. Theilacker, B. Norris and W.M. Soyars	
SEMICONDUCTOR SWITCHED CAPACITIVE CIRCUIT FOR ENERGY TRANSFER BETWEEN SUPERCONDUCTING MAGNETS	477
J.R. Baker and J.D. Walters	
HIGH GRADIENT MAGNETIC SEPARATION APPLIED TO ENVIRONMENTAL REMEDIATION	485
F.C. Prenger, W.F. Stewart, D.D. Hill, L.R. Avens, L.A. Worl, A. Schake, K.J. de Aguero, D.D. Padilla and T.L. Tolt	

Large Scale Systems

THE JET CRYOSYSTEM, OVERVIEW AND EXPERIENCE.....	493
W. Obert	
CRYOGENIC SYSTEM OF THE NUCLOTRON - A NEW SUPERCONDUCTING SYNCHROTRON.....	501
A.M. Baldin, N.N. Agapov, V.A. Belushkin, E.I. D'yachkov, H.G. Khodzhibagyan, A.D. Kovalenko, L.G. Makarov, E.A. Matyushevsky and A.A. Smirnov	
DESIGN AND OPTIMIZATION OF A HELIUM REFRIGERATOR FOR TESTING LARGE SUPERCONDUCTING MAGNETS	509
G.E. Kinard, L.J. Lestochi and H.C. Parish	
UPGRADE OF THE TEVATRON CRYOGENIC SYSTEM.....	517
J. Theilacker	
FERMILAB CENTRAL HELIUM LIQUEFIER SYSTEM UPGRADE.....	523
J. Makara, T. Barnes, R.J. Bossert, M. Geynisman, G. Hodge, R. Kolar and R. Walker	
CRYOGENIC COOLING SYSTEM FOR THE GROUND TEST ACCELERATOR	531
F.J. Edeskuty, W.F. Stewart, J. Moeller, F. Durham and I. Spulgis	
APPLICATION OF LIQUID-HELIUM CRYOPLANTS AT CERN.....	539
J-P. Dauvergne, D. Delikaris, W.K. Erdt, D. Güsewell, F. Haug, Ph. Lebrun, G. Passardi, J.M. Rieubland, J. Schmid and G. Winkler	

PERFORMANCE OF AN EFFICIENT 6KW HELIUM REFRIGERATOR FOR THE LEP 200 PROJECT AT CERN	553
W.K. Erdt, P. Frandsen, D. Güsewell, K. Kurtcuoglu, K. Lölein, A.-E. Senn, N.O. Solheim, U. Wagner, G. Winkler and B. Ziegler	
PERFORMANCE TESTS OF A 2 KW HE REFRIGERATOR FOR SC MAGNET TESTS DOWN TO 3.3 K.....	563
F. Spath, R. Heil, W. Lehmann, J. Lesser, H. Schimmer and J. Weber	
REPORT ON OPERATIONAL EXPERIENCE AND RELIABILITY OF THE HERA CRYOGENIC SYSTEM	571
H. Berg, M. Clausen, H. Herzog, G. Horlitz and H. Lierl	
R&D OF HIGH RELIABILITY REFRIGERATION SYSTEM FOR SUPERCONDUCTING GENERATORS	581
K. Arai, T. Ogawa, A. Yasuda, R. Toyama, D. Kato and K. Fujima	
THERMAL PERFORMANCE OF THE CEBAF SUPERCONDUCTING LINAC CRYOMODULE.....	589
W. Schneider, W. Chronis, M. Drury, D. Machie, J. Marshall, J. Preble, J. Robb, C. Rode, Q. Saulter and M. Wiseman	
CEBAF'S SRF CAVITY MANUFACTURING EXPERIENCE	597
J.F. Benesch and C.E. Reece	
A 1.8 K TEST FACILITY FOR SUPERCONDUCTING RF CAVITIES.....	605
G. Horlitz, U. Knopf, R. Lange, B. Peterson, T. Peterson, D. Sellmann and D. Trines	
HEAT LEAK ANALYSIS ON A CRYOSTAT SUSPENSION SYSTEM WITH COMPLEX GEOMETRY	613
B. Zhang	
HEAT TRANSFER DESIGN AND PERFORMANCE OF A HELIUM CRYOSTAT OPERATING AT 6.5 K.....	619
T.H. Gasteyer, K.J. Krempetz, A. Lee, R.A. Rucinski and A.M. Stefanik	
REDUCTION OF HYDROCARBON IMPURITIES IN 200 L/H HELIUM LIQUEFIER-REFRIGERATOR SYSTEM	627
S. Yamada, T. Mito, A. Nishimura, K. Takahata, S. Satoh, J. Yamamoto, H. Yamamura, K. Masuda, S. Kashihara, K. Fukusada and E. Tada	
Large Hadron Collider - LHC	
DESIGN CRITERIA OF THE CRYOGENIC SYSTEM FOR THE CERN LHC INJECTION LINES.....	635
N. Delruelle, G. Kouba, G. Passardi and J. Tischhauser	
CRYOGENIC INFRASTRUCTURE FOR SUPERFLUID HELIUM TESTING OF LHC PROTOTYPE SUPERCONDUCTING MAGNETS	641
V. Benda, G. Duraffour, A. Guiard-Marigny, Ph. Lebrun, F. Momal, R. Saban, V. Sergo, L. Tavian and B. Vuillierme	
THE SUPERFLUID HELIUM MODEL CRYOLOOP FOR THE CERN LARGE HADRON COLLIDER (LHC)	649
A. Bézaguet, J. Casas-Cubillos, Ph. Lebrun, M. Marquet, L. Tavian and R. Van Weelderen	
LEAK-TIGHTNESS ASSESSMENT OF DEMOUNTABLE JOINTS FOR THE SUPER-FLUID HELIUM SYSTEM OF THE CERN LARGE HADRON COLLIDER (LHC)	657
J.-C Brunet, A. Poncet and Ph. Trilhe	
DESIGN AND CONSTRUCTION OF A PROTOTYPE SUPERFLUID HELIUM CRYOSTAT FOR THE SHORT STRAIGHT SECTIONS OF THE CERN LARGE HADRON COLLIDER (LHC)	663
W. Cameron, B. Jenny, G. Riddone, P. Rohmig and R. Van Weelderen	
DESIGN, CONSTRUCTION AND PERFORMANCE OF SUPERCONDUCTING MAGNET SUPPORT POSTS FOR THE LARGE HADRON COLLIDER.....	671
M. Blin, H. Danielsson, B. Evans and M. Mathieu	

Superconducting Super Collider - SSC

HISTORY, STATUS AND PLANS FOR THE SUPER COLLIDER.....	679
J. Warren	
CRYOGENIC SYSTEMS FOR THE SSC AND THE STATUS OF THEIR DEVELOPMENT	689
W.A. Fietz, V. Ganni, S. Abramovich and T. Niehaus	
SUPERCONDUCTING MAGNETS, CRYOSTATS AND CRYOGENICS FOR THE INTERACTION REGION OF THE SSC.....	701
R.J. Jayakumar, S. Abramovich, A. Ahmad, B. Archer, W. Clay, C. Goodzeit, A. Harvey, A. Jalloh, Q.S. Shu, G. Snitchler and R. Stiening	
FINITE ELEMENT STUDY OF THE QUENCH BEHAVIOR OF A SOLENOID FOR SSC DETECTOR	709
A. Lee, R.W. Fast and R.H. Wands	
DESIGN FEATURES, FABRICATION ISSUES, AND PERFORMANCE RESULTS FOR SSC QUADRUPOLE MAGNETS	717
J.A. Waynert	
CRYOSTAT DESIGN FOR SSC QUADRUPOLE MAGNETS	723
G.A. Lehmann, K.E. Grut, M.W. Hiller, X. Huang, D.T. Stutzki and J.A. Waynert	
B & W'S MAGNET TEST FACILITY FOR SSC COLLIDER QUADRUPOLE MAGNETS	731
J.P. Kelley, M.E. Stone, A.L. Billingsly, B.I. Cantor, J-J. Clausen, K.D. Dixon, P. Hlasniecek, K. Kurtcuoglu, K. Löhlein, J.E. Maloney, G. Pare, C.M. Rey, J. Savignano, R.H. Schaffer and A.E. Senn	
B&W VERTICAL TEST FACILITY FOR SSC COLLIDER QUADRUPOLE MAGNETS	739
K.D. Dixon, A.L. Billingsly, D.W. Boyes, B.I. Cantor, P. Hlasniecek, J.P. Kelley, C.K. Leamon, J.E. Maloney, G. Paré, C.M. Rey, J.A. Savignano, M.E. Stone and D.L. Whorley	
STATUS OF DESIGN, DEVELOPMENT AND TEST OF THE DIPOLE MAGNETS FOR THE HIGH ENERGY BOOSTER.....	747
J.M. Butler, G. Boulios, K. Fingers, L. Kaylor, A. McConnon, S. McConnon, S. Osborne, Z. Sinnott, F. Pisz, C. Swenson, C. Wolf, M. Krefta, O.R. Christianson, R. Marloff, J.F. Roach, J. Snyder and D. Thompson	
R & D OF A PROTOTYPE SSC 80-K SYNCHROTRON RADIATION LINER SYSTEM IN A HALF-CELL OF 40K MAGNETS.....	759
Q.-S. Shu, W. Chou, D. Clark, W. Clay, Y. Goren, R. Kersevan, V. Kovachev, P. Kraushaar, K.K. Leung, J. Maddocks, D. Martin, D. Meyer, R. Mihelic, G. Morale, C. Ruiz, G. Snitchler, M. Tuli, W. Turner, L. Walling, K. Yu and J. Zbasnik	
EDDY CURRENT AND QUENCH LOADS FOR THE SSC 4-K LINER AND BORE TUBE DURING COLLIDER MAGNET QUENCH	771
K.K. Leung and Q.S. Shu	
DESIGN VERIFICATION AND ACCEPTANCE TESTS OF THE ASST-A HELIUM REFRIGERATION SYSTEM.....	779
V. Ganni and T.V. Apparao	
PEAK LOOP PRESSURE AND TEMPERATURE AND COMPARISON OF TOTAL COOLING PROVIDED TO THE ENERGY RELEASED AFTER LOW CURRENT QUENCHES OF SSC DIPOLES IN MAGCOOL CRYOGENIC SYSTEM.....	789
K.C. Wu	
SELF-DRIVEN HE II COOLING SYSTEM FOR THE INTERACTION REGION FOCUSING MAGNETS AT SSC	797
A.J. Mord and H.A. Snyder	

Superconducting Magnetic Energy Storage - SMES

SIMPLE ESTIMATE OF STORED ENERGY AND CONDUCTOR INSULATION VOLTAGE- WITHSTAND REQUIREMENTS FOR ADVANCED SOLENOID MAGNET DESIGNS.....	805
S.W. Schwenterly and L. Dresner	
DESIGN AND ANALYSIS OF SMES-ETM ELECTRICAL INSULATION.....	813
J.L. Wu, J.F. Roach, D.C. Johnson, J.T. Dederer, S.K. Singh and D.T. Hackworth	

CONDUCTOR SELECTION FOR SMES APPLICATIONS.....	821
O.R. Christianson, Y.M. Essya, X. Huang, S.K. Singh and R.W. Boom	
SUPERCONDUCTING MAGNETIC ENERGY STORAGE (SMES) USING HIGH TEMPERATURE SUPERCONDUCTORS (HTS) IN THREE GEOMETRIES	829
S.M. Schoenung, R.L. Bieri and T.C. Bickel	
THERMAL ANALYSES OF THE SMES ETM POWER BUS CRYOSTAT.....	837
E.F. Daly, T. Kupiszewski and O.R. Christianson	
HELUM TRANSPORT PHENOMENA IN THE 200 KA SMES/CICC	847
C.A. Luongo, C.L. Chang, S.D. Peck and G.A. Armour	
DESIGN AND OPERATION OF A ROBUST CRYOSTAT FOR COMMERCIAL SUPERCONDUCTING ENERGY STORAGE SYSTEMS.....	855
M.A. Daugherty, W.E. Buckles and R.C. Niemann	
Compressors And Expanders	
SELECTION OF COLD COMPRESSORS FOR THE FERMILAB TEVATRON	863
J.D. Fuerst	
DESIGN OF SUBCOOLED HELIUM II REFRIGERATOR WITH HELIUM-3 COLD COMPRESSOR.....	871
D. Kato, N. Saji, H. Ohya, H. Asakura, M. Kubota, Y. Kaneko and S. Nagai	
THE IMPROVEMENT OF SCREW COMPRESSOR PERFORMANCE USING A NEWLY DEVELOPED ROTOR PROFILE.....	879
T. Kishi, T. Nishio, A. Matsui and N. Ino	
TEST OF AN IMPROVED OIL INJECTED HELIUM SCREW COMPRESSOR AT FERMILAB ..	887
A. Martinez and C.B. Pallaver	
PERFORMANCE TEST RESULT OF 80 K CENTRIFUGAL COMPRESSOR FOR HELIUM REFRIGERATOR.....	893
H. Asakura, D. Kato, N. Saji, H. Ohya, M. Kubota, Y. Kaneko, S. Nagai and R. Toyama	
A HELIUM REGENERATIVE COMPRESSOR.....	901
W.L. Swift, W.E. Nutt and H. Sixsmith	
DYNAMIC CHARACTERISTICS OF A TILTING-PAD BEARING SYSTEM FOR HIGH EXPANSION RATIO EXPANDER	909
J. Qiu, T. Takagi, J. Tani, A. Machida, K. Tsugawa, H. Yanagi and N. Ino	
DESIGN AND TEST OF A WET TYPE HELIUM TURBO-EXPANDER WITH AN ALTERNATOR AS A BRAKE.....	917
T. Kato, A. Miyake, K. Kawano, K. Hamada, T. Hiyama, S. Iwamoto, H. Ebisu, H. Tsuji, N. Saji, Y. Kaneko, H. Asakura, M. Kubota and S. Nagai	
Mechanisms and Machinery	
HIGH EFFICIENCY, VARIABLE GEOMETRY, CENTRIFUGAL CRYOGENIC PUMP.....	925
M.D. Forsha, K.E. Nichols and C.A. Beale	
OPERATION MODES OF A 50-60 HZ SUPERCONDUCTING CONVERTER.....	933
O.A. Shevchenko, H.H.J. ten Kate, E.J.G. Krooshoop and N.V. Markovsky	
OPERATION OF A TEST BED AXIAL-GAP BRUSHLESS DC ROTOR WITH A SUPERCONDUCTING STATOR.....	941
J.W. McKeever, C.W. Sohns, S.W. Schwenterly, R.W. Young, Sr., V.W. Campbell, M.H. Hickey, G.W. Ott and J.M. Bailey	
PROGRESS TOWARD MEGAWATT CLASS SUPERCONDUCTING GENERATORS WHICH OPERATE AT GREATER THAN 20 KELVIN	949
C.E. Oberly, C. Joshi, A.J. Rodenbush, S.J. Young, L.J. Long and G. Kozlowski	
THE CRYOGENIC PERFORMANCE OF NbTi SUPERCONDUCTOR WIRE LINEAR ACTUATOR.....	957
S.H. Stewart and M.T. Stier	
ROTARY BAYONETS FOR CRYOGENIC AND VACUUM SERVICE.....	965
R.A. Rucinski, K.D. Dixon, R. Krasa, K.J. Krempetz, G.T. Mulholland, G.R. Trotter and J.B. Urbin	

Safety

ODH, OXYGEN DEFICIENCY HAZARD CRYOGENIC ANALYSIS	979
S.D. Augustynowicz	
AN EXPERIMENTAL STUDY OF CATASTROPHIC LOSS OF VACUUM FOR RHIC DIPOLE IN MAGCOOL	987
K.C. Wu, D.P. Brown, J. Sondericker and D. Zantopp	
LOSS OF CAVITY VACUUM EXPERIMENT AT CEBAF.....	997
M. Wiseman, K. Crawford, M. Drury, K. Jordan, J. Preble, Q. Saulter and W. Schneider	
SYSTEM SAFETY DESIGN CONSIDERATIONS FOR CRYOGENIC PAYLOAD SERVICING AT KENNEDY SPACE CENTER.....	1005
S.K. Dion and C.A. Conaty	

