COOPER-BESSEMER RECIPROCATING

F. Bruce Stolba
Vice President and General Manager

September 28, 1989

Our Ref: QCG-6363

Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Director of Inspection and Enforcement

Subject: KSV Standby Diesel/Generator
Pennsylvania Power and Light
Unit "B", Crankcase Explosion

The attached report reference QCG-6360 covers an incident which occurred on September 16, 1989 at the Pennsylvania Power and Light Susquehanna Steam Electric Station. The number "B" unit (S.N. 7159) which was on a twenty-four hour test suffered a crankcase explosion. Subsequent inspection showed the cause to have originated from the thrust side of the number seven left piston skirt. The affected piston and liner and the adjacent one (number seven right) was removed and replaced. The incident is regarded as unique and consequently no further action is contemplated by Cooper-Bessemer.

As a completely separate issue, the matter of piston pin cap migrating and contacting the cylinder liner wall will be reviewed. Experience shows that this migration arises spasmodically without rendering an engine inoperable.

Sincerely,

F. Bruce Stolba

FBS/gs

Attachment

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(412) 458-8000 Telex: 86-6613

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D. T. Blizzard - GC
F. Czysz - P.P.& L.
T. O. Garrison - Odessa
B. C. Guntrum - C-E Oakland
B. K. Hall - GC

cc: T. W. Kearns - GC
W. H. A. Lambert - GC
W. Leishman - ESG Mt. Vernon
R. A. Miklos - GC
C. Rousselle - ESG New Orleans
B. R. Sedelmyer - GC
K. R. Young - ESG Houston

KSV Users Group: Mark Brutcher - Arizona Public Service
Todd Fiorenza - Carolina Power and Light
Terry O'Brien - Commonwealth Edison
Jim Cole - Houston Light and Power
Bob Legere - Louisiana Power and Light
Darren Dageforde - Nebraska Public Power District
Thomas Fannestock - Niagara Mohawk
Frank Czysz - Pennsylvania Power and Light

File: K5fa16

QCG-6360 9/27/89

REPORT

Pennsylvania Power and Light Company
Standby Diesel/Generator KSV-16-T
Unit "B" S/N 7159
Crankcase Explosion - Sept. 7, 1989, No. 7 Left Cylinder

1.0 Introduction

1.1 During the morning of Saturday, September 16, 1989, Unit "B" was on a twenty-four hour test run.

1.2 With a load of 4700 KW the engine suffered a crankcase explosion at approximately 09:50. A "normal" stop was initiated in the control room and the engine was brought to rest at 09:54.

1.3 Inspection revealed that the source of ignition for the crankcase explosion was within the number 7 left cylinder.

1.4 Both the 7 left and right cylinder liners and pistons were replaced It was observed that extreme distress had occurred to the 7 left liner and piston skirt.

1.5 Inspections were carried out by various P.P. & L. and C-B personnel. With the exception of the reference to the fuel nozzle tip all observations recorded herein were made by C-B representative Allen Lambert during a site visit on September 22, 1989.

2.0 Observations

2.1 Prior to the crankcase explosion no anomalies with respect to engine operation were apparent.

2.2 The possibility of the lube oil film being washed away by unburned fuel oil was considered. Consequently, the fuel nozzle holder assembly was removed and tested. It was reported that the spray pattern was within normal limits.

2.3 The "thrust" or loaded side of the piston was extensively "worn". Material displaced from the 7 left piston skirt closed over the lower oil ring and "locked" it in its groove. It was, therefore, not possible to determine the extent of either distress to the ring or whether the ring itself was the seat of the origin of failure. Nevertheless, the extent of the piston skirt "wear" was indicative of having run many hours in a slowly deteriorating state.

2.4 Matching heavy contact with the 7 left piston was observed on the 7 left liner. The area of contact showed extensive heat checking all over as well as a uniformly dense wear pattern. In other words, complete contact of the piston surface to the liner was established over a large area. A narrow (approx. 1-1/2") line of heavy contact between piston and liner was observed 180° from the "thrust" face. This is consistent with the piston expanding and closing the clearance to the liner due to the thermal expansion of the piston resulting from the abnormal friction on the "thrust" side.

2.5 Both piston pin caps removed from the 7 left piston showed signs of contact with the cylinder liner. The aft end cap evidenced heavy contact. It was reported that upon removal from the cylinder both piston pin caps were found to be below the external surface of the piston. (See attached KSV-5-2 drawing for piston assembly detail).

2.6 A "tartan" like pattern, one in which areas of unburned chrome plating were surrounded by heavy contact and burning, and in a uniform pattern, were observed in the number 7 left cylinder liner in line with the ends of the piston pin. The dark areas were heat checked. This indicated that contact with the piston had in this area been less intense than at the thrust face.

2.7 An inspection of the inside of the 7 left piston showed very heavy carbon behind the skirt on the thrust side, with considerably less on the opposite side. By comparison there was very little carbon build-up on the cast bosses which retain the ends of the piston pin bushing.

2.8 The loaded surface of the 7 left piston pin was in good condition. The shape of the articulated rod end was readily discernible from the minor fretting which results from the pin "seating" itself under the firing load - this pattern was normal. At each end of the pin,and on the same side which was at 90° to the loaded surface, there were "light" burn marks. One end can be described as "very light".

2.9 The 7 left piston pin bushing reflected the observations made with respect to the piston pin. The loaded surface was in excellent condition with no sign of abnormal wear, in fact, no signs of wear at all, and no indication of any foreign material being present.

2.10 Apart from damage to the lower oil ring, which could not be assessed in total (see para. 2.3), all other rings appeared to be in good order. The top two compression rings were bent, damaged no doubt, during piston removal, however, their "running" surface indicated normal operation. The other four rings exhibited freedom of movement in their respective ring grooves and no untoward damage to them was apparent. A subsequent closer look by P.P. & L. revealed "dulling" of the knife edge of oil ring (second from the bottom) and a build-up of displaced piston skirt material under the "scraper" edge.

2.11 The lower liner seal is a stainless steel bellows which provides a flexible connection between the bottom of the cylinder liner and the cylinder block. Cooling water that seeps into the space between the seal and liner skirt is trapped with no flow required or occurring. The seal removed from the 7 left cylinder liner was extensively deformed presumably because the trapped water turned into steam caused by the added heat from the 7 left piston thrust face heavy contact.

3.0 Discussion

3.1 The most pertinent observations relevant to the failure origin are as follows:

3.2 The heavy wear pattern on the thrust side of the piston/cylinder - See Para. 2.3.

3.3 Heavy carbon deposits on the inside of the piston skirt on the thrust side - See para. 2.7.

3.4 By comparison to the heavy loading in evidence on the thrust face, the areas in line with the ends of the piston pin were not as heavily loaded - See para. 2.6.

3.5 Perhaps the most revealing observation is that the piston pin bushing was in excellent condition - See para. 2.9. The piston pin and bushing assembly is very sensitive to any distress in the area immediately adjacent to it. Had excessive heat build-up occurred due to the piston pin caps rubbing the cylinder walls, this heat would have been transmitted directly to the piston pin bushing. Expansion of the bushing would then cause the clearance to the pin to be taken up resulting in heavy contact with the pin which in turn would cause overheating and consequent yielding of the bushing material.

3.6 The water which, it is postulated, turned to steam in the lower liner seal resulted from abnormally high localized heating from the piston to liner wearing which occurred in the skirt area. If the high friction area had been higher in the cylinder the seal (convoluted bellows) would not have been buckled because the excess heat load would have been removed by the flow of jacket cooling water - See para. 2.11.

4.0 Conclusion

4.1 From the discussion in paragraph 3.0 of the observations made, it is concluded that the primary failure occurred in the lower piston skirt on the thrust face.

4.2 It was not possible to determine the condition of the lower oil ring and, therefore, it is not possible to state whether the failure was due to a chipped or damaged ring surface, a cracked ring or the introduction of foreign material between the piston skirt and the cylinder.

4.3 This failure is regarded as being unique with no generic implications.

4.4 Attached is a copy of the handwritten "Failure-Evaluation" given to site personnel on September 22, 1989.

5.0 Additional Observations

5.1 The number 7 right piston and cylinder were removed and replaced due to a heavy score of the liner which matched contact marks on one piston pin cap.

5.2 The piston pin cap has a nominal fit of metal-to-metal to .003" tight. It is, therefore, very rigidly held in place. Under normal operating conditions there can be no contact between the piston pin and the cap due to the built-in clearance. Nevertheless, migration of these caps has from time to time been observed, and if the cap should contact the cylinder surface it will "go along for the ride" with no serious distress occurring.

5.3 As a separate issue from the number 7 left failure, the application of the piston pin cap will be reviewed.

W. H. A. Lambert
Manager, Quality Assurance

cc: R. J. Brager
A. E. Bice
D. T. Blizzard
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B. K. Hall
M. J. Helmich
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M. A. Schleigh
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File: 5-1
SO-0188/P2
K5fa16

WHAL/klk

SEPT. 22-89

P.P.&L. KSV-16-T
UNIT "B" S.N.7159
No. 5 LEFT PISTON
FAILURE – EVALUATION

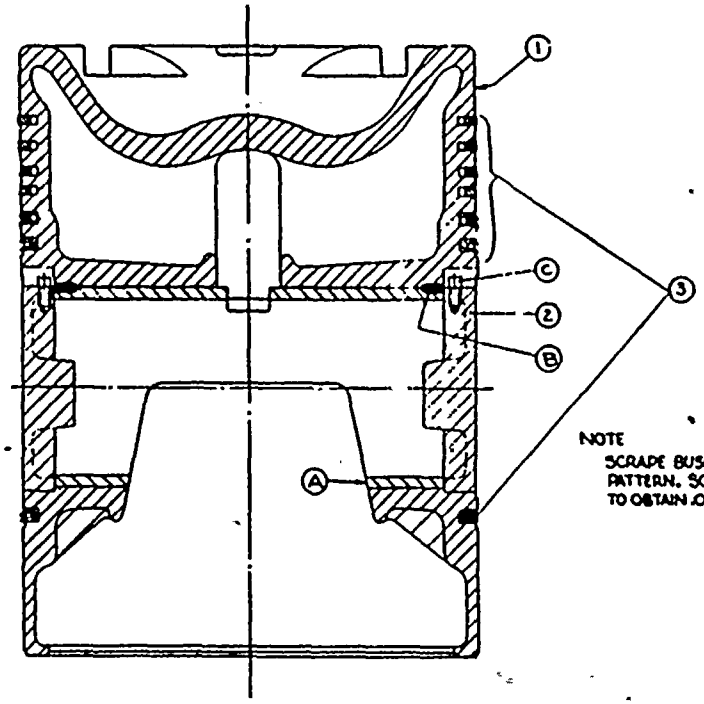
THE INFORMATION OBTAINED CONCERNING THE CIRCUMSTANCES OF A CRANKCASE EXPLOSION ON SEPTEMBER 16, 1989 HAS BEEN REVIEWED TOGETHER WITH DIRECT OBSERVATION OF THE AFFECTED (DISTRESSED) COMPONENTS. THIS HAS LED TO THE CONCLUSION THAT THE PRIMARY FAILURE OCCURED IN THE AREA OF THE PISTON SKIRT ON THE LOADED (OR THRUST) SIDE OF THE PISTON. THE REASONS ARE SUMMARIZED AS FOLLOWS:

1. THE PISTON PIN AND BUSHING SHOW MINIMAL DISTRESS WITH NO EVIDENCE OF ABNORMAL LOADING.
2. THE PISTON SKIRT SHOWS "WEAR" AND CONSEQUENT CONFORMITY TO THE LINER CONTOUR THAT CAN ONLY HAPPEN OVER A PERIOD OF HOURS. THE CONTACT OF THE PISTON/LINER COVERS A LARGE AREA AND HAS A UNIFORMITY OF APPEARANCE OVER THAT AREA.
3. 180° OPPOSED TO THE "THRUST" SIDE OF THE PISTON IS A NARROW BAND OF HEAVY CONTACT. THIS SUGGESTS THAT AS THE PISTON HEATED AND GREW THERMALLY IT ESTABLISHED A SECOND UNIFORM BUT NARROW BAND OF HEAVY CONTACT.
4. 90° OPPOSED TO THE "THRUST" SIDE OF THE PISTON (IN-LINE WITH THE PISTON PIN) A DISCONTINUOUS CONTACT PATTERN IS EVIDENT. THIS INDICATES THAT IT DID NOT HAVE HEAVY CONTACT FOR A LONG ENOUGH TIME TO PRODUCE A "UNIFORM" WEAR PATTERN.
5. THE PISTON END CAPS WERE EXAMINED AND NOTED TO HAVE SUFFERED DISTRESS BY VIRTUE OF CONTACT WITH THE CYLINDER WALL. THIS DISTRESS IS NOT CONSIDERED TO BE THE PRIMARY CAUSE OF FAILURE.

D. A. HANAWAY
COOPER-BESSEMER RECIP

KSV-5-2
Revisic

PART	NAME	PART NO	MATL	REMARKS	REQ'D
-1	POWER PISTON	KSV-5A#2	C.I.	CRITICAL	1
2	PISTON PIN CAP	KSV-8C#2	C.I.	CRITICAL	2
3	RING SET	SD-94-KSV-9	COMP.		1



NOTE
SCRAPE BUSHING TO OBTAIN GOOD BLUE PATTERN. SCRAPE BUSHING BALS ONLY TO OBTAIN .005-.006 FEELER CLEARANCE.

THE FOLLOWING ITEMS FOR REPAIRS ONLY

1	PISTON PIN BUSHING	KSV-5-A1#2	BRZ	CRITICAL	A
2	SCREW DOWEL-1/4-20 X #2	CSA-86-018-004	ST'L		B
2	SCREW (SET 5/8-16 x 1/2)	SP-76-034-004	ST'L		C

ABOVE B/M IS FOR ONE CYLINDER

NOTE #1
ASSEMBLE PISTON IN ENGINE WITH COOLING OIL DISCHARGE TOWARD CENTER OF ENGINE, BOTH BANKS

NOTE #2
MAXIMUM END GAP, SPREAD OF COMPRESSION RINGS DURING INSTALLATION OVER PISTON TO BE 3.5 mm.

NUCLEAR STANDBY

INSPECT AT ASSEMBLY PER QCP-12-12

3		
2		
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	30-0486	

PISTON-POWER (w/ COOLING)

KSV-5-2

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COOPER-BESSEMER RECIPROCATING

F. Bruce Stolba
Vice President and General Manager

September 28, 1989

Our Ref: QCG-6363

Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Director of Inspection and Enforcement

Subject: KSV Standby Diesel/Generator
Pennsylvania Power and Light
Unit "B", Crankcase Explosion

The attached report reference QCG-6360 covers an incident which occurred on September 16, 1989 at the Pennsylvania Power and Light Susquehanna Steam Electric Station. The number "B" unit (S.N. 7159) which was on a twenty-four hour test suffered a crankcase explosion. Subsequent inspection showed the cause to have originated from the thrust side of the number seven left piston skirt. The affected piston and liner and the adjacent one (number seven right) was removed and replaced. The incident is regarded as unique and consequently no further action is contemplated by Cooper-Bessemer.

As a completely separate issue, the matter of piston pin cap migrating and contacting the cylinder liner wall will be reviewed. Experience shows that this migration arises spasmodically without rendering an engine inoperable.

Sincerely,

F. Bruce Stolba

FBS/gs

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IE19
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B. K. Hall - GC

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Frank Czysz - Pennsylvania Power and Light

File: K5fa16

QCG-6360 9/27/89

REPORT

Pennsylvania Power and Light Company
Standby Diesel/Generator KSV-16-T
Unit "B" S/N 7159
Crankcase Explosion - Sept. 7, 1989, No. 7 Left Cylinder

1.0 Introduction

1.1 During the morning of Saturday, September 16, 1989, Unit "B" was on a twenty-four hour test run. .

1.2 With a load of 4700 KW the engine suffered a crankcase explosion at approximately 09:50. A "normal" stop was initiated in the control room and the engine was brought to rest at 09:54.

1.3 Inspection revealed that the source of ignition for the crankcase explosion was within the number 7 left cylinder.

1.4 Both the 7 left and right cylinder liners and pistons were replaced It was observed that extreme distress had occurred to the 7 left liner and piston skirt.

1.5 Inspections were carried out by various P.P. & L. and C-B personnel. With the exception of the reference to the fuel nozzle tip all observations recorded herein were made by C-B representative Allen Lambert during a site visit on September 22, 1989.

2.0 Observations

2.1 Prior to the crankcase explosion no anomalies with respect to engine operation were apparent.

2.2 The possibility of the lube oil film being washed away by unburned fuel oil was considered. Consequently, the fuel nozzle holder assembly was removed and tested. It was reported that the spray pattern was within normal limits.

2.3 The "thrust" or loaded side of the piston was extensively "worn". Material displaced from the 7 left piston skirt closed over the lower oil ring and "locked" it in its groove. It was, therefore, not possible to determine the extent of either distress to the ring or whether the ring itself was the seat of the origin of failure. Nevertheless, the extent of the piston skirt "wear" was indicative of having run many hours in a slowly deteriorating state.

2.4 Matching heavy contact with the 7 left piston was observed on the 7 left liner. The area of contact showed extensive heat checking all over as well as a uniformly dense wear pattern. In other words, complete contact of the piston surface to the liner was established over a large area. A narrow (approx. 1-1/2") line of heavy contact between piston and liner was observed 180^{0} from the "thrust" face. This is consistent with the piston expanding and closing the clearance to the liner due to the thermal expansion of the piston resulting from the abnormal friction on the "thrust" side.

2.5 Both piston pin caps removed from the 7 left piston showed signs of contact with the cylinder liner. The aft end cap evidenced heavy contact. It was reported that upon removal from the cylinder both piston pin caps were found to be below the external surface of the piston. (See attached KSV-5-2 drawing for piston assembly detail).

2.6 A "tartan" like pattern, one in which areas of unburned chrome plating were surrounded by heavy contact and burning, and in a uniform pattern, were observed in the number 7 left cylinder liner in line with the ends of the piston pin. The dark areas were heat checked. This indicated that contact with the piston had in this area been less intense than at the thrust face.

2.7 An inspection of the inside of the 7 left piston showed very heavy carbon behind the skirt on the thrust side, with considerably less on the opposite side. By comparison there was very little carbon build-up on the cast bosses which retain the ends of the piston pin bushing.

2.8 The loaded surface of the 7 left piston pin was in good condition. The shape of the articulated rod end was readily discernible from the minor fretting which results from the pin "seating" itself under the firing load - this pattern was normal. At each end of the pin,and on the same side which was at 90^{0} to the loaded surface, there were "light" burn marks. One end can be described as "very light".

2.9 The 7 left piston pin bushing reflected the observations made with respect to the piston pin. The loaded surface was in excellent condition with no sign of abnormal wear, in fact, no signs of wear at all, and no indication of any foreign material being present.

2.10 Apart from damage to the lower oil ring, which could not be assessed in total (see para. 2.3), all other rings appeared to be in good order. The top two compression rings were bent, damaged no doubt, during piston removal, however, their "running" surface indicated normal operation. The other four rings exhibited freedom of movement in their respective ring grooves and no untoward damage to them was apparent. A subsequent closer look by P.P. & L. revealed "dulling" of the knife edge of oil ring (second from the bottom) and a build-up of displaced piston skirt material under the "scraper" edge.

2.11 The lower liner seal is a stainless steel bellows which provides a flexible connection between the bottom of the cylinder liner and the cylinder block. Cooling water that seeps into the space between the seal and liner skirt is trapped with no flow required or occurring. The seal removed from the 7 left cylinder liner was extensively deformed presumably because the trapped water turned into steam caused by the added heat from the 7 left piston thrust face heavy contact.

3.0 Discussion

3.1 The most pertinent observations relevant to the failure origin are as follows:

3.2 The heavy wear pattern on the thrust side of the piston/cylinder - See Para. 2.3.

3.3 Heavy carbon deposits on the inside of the piston skirt on the thrust side - See para. 2.7.

3.4 By comparison to the heavy loading in evidence on the thrust face, the areas in line with the ends of the piston pin were not as heavily loaded - See para. 2.6.

3.5 Perhaps the most revealing observation is that the piston pin bushing was in excellent condition - See para. 2.9. The piston pin and bushing assembly is very sensitive to any distress in the area immediately adjacent to it. Had excessive heat build-up occurred due to the piston pin caps rubbing the cylinder walls, this heat would have been transmitted directly to the piston pin bushing. Expansion of the bushing would then cause the clearance to the pin to be taken up resulting in heavy contact with the pin which in turn would cause overheating and consequent yielding of the bushing material.

3.6 The water which, it is postulated, turned to steam in the lower liner seal resulted from abnormally high localized heating from the piston to liner wearing which occurred in the skirt area. If the high friction area had been higher in the cylinder the seal (convoluted bellows) would not have been buckled because the excess heat load would have been removed by the flow of jacket cooling water - See para. 2.11.

4.0 Conclusion

4.1 From the discussion in paragraph 3.0 of the observations made, it is concluded that the primary failure occurred in the lower piston skirt on the thrust face.

4.2 It was not possible to determine the condition of the lower oil ring and, therefore, it is not possible to state whether the failure was due to a chipped or damaged ring surface, a cracked ring or the introduction of foreign material between the piston skirt and the cylinder.

4.3 This failure is regarded as being unique with no generic implications.

4.4 Attached is a copy of the handwritten "Failure-Evaluation" given to site personnel on September 22, 1989.

5.0 Additional Observations

5.1 The number 7 right piston and cylinder were removed and replaced due to a heavy score of the liner which matched contact marks on one piston pin cap.

5.2 The piston pin cap has a nominal fit of metal-to-metal to .003" tight. It is, therefore, very rigidly held in place. Under normal operating conditions there can be no contact between the piston pin and the cap due to the built-in clearance. Nevertheless, migration of these caps has from time to time been observed, and if the cap should contact the cylinder surface it will "go along for the ride" with no serious distress occurring.

5.3 As a separate issue from the number 7 left failure, the application of the piston pin cap will be reviewed.

W. H. A. Lambert
Manager, Quality Assurance

cc: R. J. Brager
A. E. Bice
D. T. Blizzard
W. O. Ferguson
B. K. Hall
M. J. Helmich
J. M. Horne
W. Leishman - MV
R. A. Miklos
M. A. Schleigh
B. R. Sedelmyer
File: 5-1
SO-0188/P2
K5fa16

WHAL/klj

SEPT. 22-89

P.P. & L. KSV-16-T
UNIT "B" S.N. 7159
No. 5 LEFT PISTON
FAILURE – EVALUATION

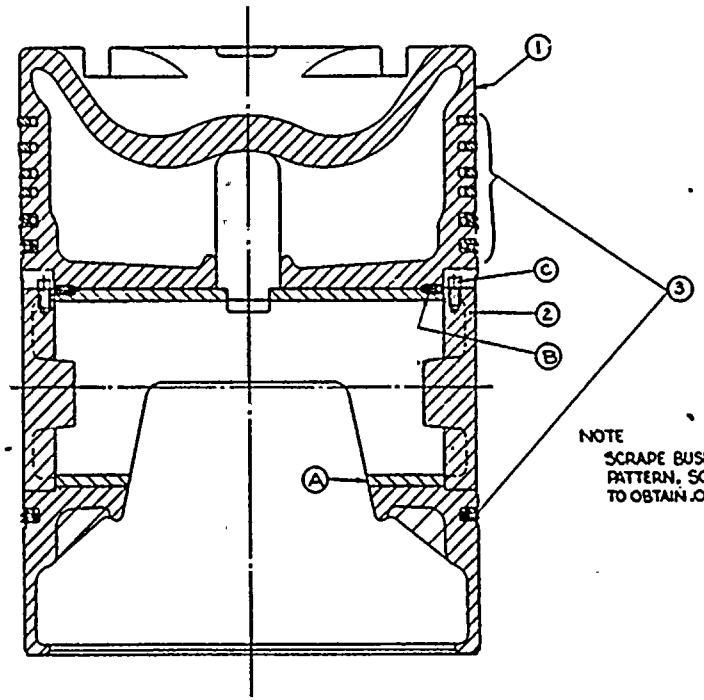
THE INFORMATION OBTAINED CONCERNING THE CIRCUMSTANCES OF A CRANKCASE EXPLOSION ON SEPTEMBER 16, 1989 HAS BEEN REVIEWED TOGETHER WITH DIRECT OBSERVATION OF THE AFFECTED (DISTRESSED) COMPONENTS. THIS HAS LED TO THE CONCLUSION THAT THE PRIMARY FAILURE OCCURED IN THE AREA OF THE PISTON SKIRT ON THE LOADED (OR THRUST) SIDE OF THE PISTON. THE REASONS ARE SUMMARISED AS FOLLOWS:

1. THE PISTON PIN AND BUSHING SHOW MINIMAL DISTRESS WITH NO EVIDENCE OF ABNORMAL LOADING.
2. THE PISTON SKIRT SHOWS "WEAR" AND CONSEQUENT CONFORMITY TO THE LINER CONTOUR THAT CAN ONLY HAPPEN OVER A PERIOD OF HOURS. THE CONTACT OF THE PISTON/LINER COVERS A LARGE AREA AND HAS A UNIFORMITY OF APPEARANCE OVER THAT AREA.
3. 180° OPPOSED TO THE "THRUST" SIDE OF THE PISTON IS A NARROW BAND OF HEAVY CONTACT. THIS SUGGESTS THAT AS THE PISTON HEATED AND GREW THERMALLY IT ESTABLISHED A SECOND UNIFORM BUT NARROW BAND OF HEAVY CONTACT.
4. 90° OPPOSED TO THE "THRUST" SIDE OF THE PISTON (IN-LINE WITH THE PISTON PIN) A DISCONTINUOUS CONTACT PATTERN IS EVIDENT THIS INDICATES THAT IT DID NOT HAVE HEAVY CONTACT FOR A LONG ENOUGH TIME TO PRODUCE A "UNIFORM" WEAR PATTERN.
5. THE PISTON END CAPS WERE EXAMINED AND NOTED TO HAVE SUFFERED DISTRESS BY VIRTUE OF CONTACT WITH THE CYLINDER WALL. THIS DISTRESS IS NOT CONSIDERED TO BE THE PRIMARY CAUSE OF FAILURE.

D. A. MANAGER
COOPER-BESSEMER RUSSIA

KSV-5-2.
Revisic

RQD	NAME	PART NR	MATL	REMARKS	ITEM NO.
1	POWER PISTON	KSV-3A#2	C.I.	CRITICAL	1
2	PISTON PIN CAP	KSV-3C#2	C.I.	CRITICAL	2
1	RING SET	SD-94-KSV-9	COMP.		3



THE FOLLOWING ITEMS FOR REPAIRS ONLY

1	PISTON PIN BUSHING	KSV-5-A1#4	BRZ	CRITICAL	A
2	SCREW DOWEL-1/4-20 X 1/2	CSA-86-016-004	STL.		B
2	SCREW (SET 1/8-16 x 1/2)	SF-76-024-004	STL		C

ABOVE B/M IS FOR ONE CYLINDER

NOTE
SCRAPE BUSHING TO OBTAIN GOOD BLUE PATTERN. SCRAPE BUSHING BAILS ONLY TO OBTAIN .005-.006 FEELER CLEARANCE.

NOTE #1
ASSEMBLE PISTON IN ENGINE WITH COOLING OIL DISCHARGE TOWARD CENTER OF ENGINE, BOTH BANKS

NOTE #2
MAXIMUM END GAP, SPREAD OF COMPRESSION RINGS DURING INSTALLATION OVER PISTON TO BE 3.5 IN.

NUCLEAR STANDBY

INSPECT AT ASSEMBLY PER QCP-12-12

3	ADDED NOTE #2	
2		
1	CROSSED OFF ITEMS 2 & 17.C	
	50-0188	8-8-79

PISTON-POWER
(OIL COOLED)

COOPER-BESSEMER

GGH

KSV-5-2