Annex 1

Fault Trees for Tunnel

Blasting

2MIC Higher vibration due to 2 MIC detonated at tha same time

Higher vibration due to 2 MIC detonated at the same time

2.90E-05

OR

2.1-WD

Wrong design in time delay of one detonator
1.26E-09

2.2-W-DETON

1 detonator wrongly put into one sector which containes the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector 1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one 2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

3МІС

Higher vibration due to 3 MIC detonated at the same time

3MIC
Higher vibration due to 3 MIC
detonated at the same time

2.46E-07

OR

3.1-WD

Wrong design in time delay of two detonators
1.26E-11

3.2-W-DETON

Two detonators wrongly put into one sector which contains the same time delay detonator 1.68E-16

Two detonators of other sectors connected wrongly to a surface connector of another sector

1.33E-11

3.3-W-DETON-SC

3.4-W-SC

Use of two wrong surface connector 4.80E-11

3MIC-P-AD-DETON

Incorrect time default of 2 detonators due to manufacturer defect 2.40E-07

3MIC-P-AD-SC

Surface connector fails to provide necessary delay due to manufacturer defect

6.00E-09

3MIC-ER-COMB

3 MIC detonated at the same time (Due to combination of two types of errors)

2.45E-10

4MIC

Higher than expected vibration due to 4 MIC detonated at the same time

4MIC

Higher than expected vibration due to 4 MIC detonated at the same time

2.57E-09

OR

4MIC-COMB-1

4 MIC detonated (due to same error occurred three times) at the same time

2.46E-09

4MIC-COMB-2

4 MIC detonated (due to same error occurred two times and one other error) at the same time

1.37E-12

4MIC-COMB-3

4 MIC detonated (due to three different errors occur at the same time) at the same time

3.84E-16

4MIC-COMB-4

4 MIC detonated (due to charge overload and one other error occur at the same time) at the same time

1.08E-10

OL-C-EMULSION	Too much cartridged emulsion loaded into holes					
OL-C-EMULSION Too much cartridged emulsion loaded into holes 4.39E-C	06					
OR		\neg				
4.2-WD Wrong design in MIC 9.06E-C	08	4.1-C3 Too many catridges are inserted in holes and not realised 4.29E-06				
AND 4.2.1 Design error by the Blasting Enginee 8.52E-0	4.2.2 Failure to detect and correct design error 1.06E-03	OR 4.1-C1 Too many cartridges are inserted in holes 4.28E-06		4.1-C2 Cartridges from blocked holes inserted in other holes and not detected 1.40E-08		
0.522.0	1.001.03	AND 4.1.1 Excess cartridges are loaded into	4.1.3 Shotfirer does not realise holes are	AND 4.1.2-BH Cartridges from blocked holes		4.1.3 Shotfirer does not realise holes
		holes 1.77E-01	overloaded 2.42E-05	inserted in othe holes 5.80E-04		are overloaded 2.42E-05
				4.1.2 Cartridges from blocked holes are not disposed of correctly 8.13E-03	P-BH Probability of blocked holes 0.07	

detonator

4.1-WD

Wrong design in time delay of three detonators

4.1-WD		
Wrong design in time delay of three		
detonators		
1.26E-13		
AND		
3.1-WD		D AD DETON
		P-AD-DETON
Wrong design in time dealy of two		Wrong design in time delay of
detonators		additional detonator
1.26E-11		0.01
AND		
2.1-WD	P-AD-DETON	
Wrong design in time delay of one	Wrong design in time delay of	

0.01

additional detonator

1.26E-09

4.2-W-DETON

Three detonator wrongly put into one sector which contains the same time delay detonator

4.2-W-DETON

Three detonator wrongly put into one sector which contains the same time delay detonator

1.68E-18

AND

3.2-W-DETON

Two detonators wrongly put into one sector which contains the same time delay detonator

1.68E-16

P-AD-DETON

Additional detonator wrongly put into one sector which contains the same time delay detonator

0.01

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

P-AD-DETON

Additional detonator wrongly put into one sector which contains the same time delay detonator

0.01

4.3-W-DETON-SC

Two detonators of othe sectors connected wrongly to a surface connector of another sector

1	2.	١٨.	1_	D	FT	\cap	N	I-S	\sim
4.	. ၁-	· v 1	<i>-</i>	IJ	СΙ	ι,	I۷	7	ι.

Three detonators of other sectors connected wrongly to a surface connector of another sector

1.33E-13

AND

3.3-W-DETON-SC

Two detonators of other sectors connected wrongly to a surface connector of another sector

1.33E-11

P-AD-SC

Additional detonator of a sector connected wrongly to a surface connector of another sector

0.01

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface conector of another sector

1.33E-09

P-AD-SC

Additional detonator of a sector connected wrongly to a surface connector of another sector

0.01

4.4-W-SC

4.4-W-SC Use of three wrong surface connector 4.80E-13 AND 3.4-W-SC P-AD-SC Additional use of wrong surface Use of two wrong surface connector connector 4.80E-11 0.01 AND 2.4-W-SC P-AD-SC Additional use of wrong surface Use of a wrong surface connector connector

0.01

Use of three wrong surface connector

4.80E-09

4MD-DETON

Incorrect time default of 3 detonators due to manufacturer defect

4MD-DETON
Incorrect time default of 3
detonators due to manufacturer
defect

2.40E-09

AND

3MD-DETON

Manufacturer defect of two detonator such that time delay corresponds to another one

2.40E-07

P-AD-DETON

Manufacturer defect of another detonator such that time delay corresponds to another one

0.01

AND

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

P-AD-DETON

Manufacturer defect of another detonator such that time delay corresponds to another one

0.01

4MD-SC

Surface connector fails to provide necessary delay due to manufacturer defect

4MD-SC
Surface connector fails to provide

defect

6.00E-11

3MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

necessary delay due to manufacturer

6.00E-09

P-AD-SC

Manufacturer defect of another surface connector such that time delay corresponds to another one

0.01

AND

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

P-AD-SC

Manufacturer defect of another surface connector such that time delay corresponds to another one

0.01

4-MIC-COMB-1

4 MIC detonated (due to same error occurred three times) at the same time

4-MIC-COMB-1
4 MIC detonated (due to same error
occurred three times) at the same
time

2.46E-09

OR

4.1-WD

Wrong design in time delay of three detonators

1.26E-13

4.2-W-DETON

Three detonator wrongly put into one sector which contains the same time delay detonator

1.68E-18

4.3-2-DETON

Three detonators of other sectors connected wrongly to a surface connector of another sector

1.33E-13

4.4-W-SC

Use of three wrong surface connector

4.80E-13

4MIC-P-AD-DETON

Incorrect time default of 3 detonators due to manufacturer defect

2.40E-09

4MIC-P-AD-SC

Surface connector fails to provide necessary delay due to manufacturer defect

6.00E-11

4.39E-06

4.1-WD+OTH Wrong design in time delay of two detonator plus one other type of errors 4.1-WD+OTH Wrong design in time delay of one detonator plus one other type of errors 3.65E-16 AND 4.1-WD 4.1-WD-OTH One error other than one Wrong design in time delay of wrong design in time delay of one detonator one detonator 1.26E-11 2.90E-05 AND 2.1-WD P-AD-DETON 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC MD-DETON MD-SC OL-EMULSION Manufacturer defect of one Manufacturer defect of one One detonator wrongly put One detonator of a sector into one sector which contains connected wrongly to a detonator such that time surface connector such that Use of a wrong surface Wrong design in time delay of Wrong design in time delay of the same time delay surface connector of another delay corresponds to another time delay corresponds to Overcharge of emulsion more connector one detonator additional detonator detonator sector another one than required 1.26E-09 0.01 1.68E-14 1.33E-09 4.80E-09 2.40E-05 6.00E-07 4.39E-06 OL-C-EMULSION Too much cartridged emulsion loaded into holes

4.39E-06

4.2-W-DETON+OTH Two detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors 4.2-W-DETON+OTH Two detonator wrongly put into one sector which contains tha same time delay detonator plus one other type of errors 4.86E-21 AND 4.2-W-DETON 4.2-W-DETON-OTH Two detonator wrongly put One error other than one into one sector which contains detonator wrongly put into a the same time delay sector which contains the same time delay detonator detonator 1.68E-16 2.90E-05 AND 2.2-W-DETON 2.3-W-DETON-SC OL-EMULSION 2.1-WD 2.4-W-SC MD-DETON MD-SC P-AD-DETON One detonator wrongly put One additional detonator One detonator of a sector Manufacturer defect of one Manufacturer defect of one surface connector such that into one sector which contains wrongly put into one sector connected wrongly to a detonator such that time which contains the same time delay corresponds to another Overcharge of emulsion more the same time delay surface connector of another time delay corresponds to Wrong design in time delay of Use of a wrong surface delay detonator one detonator another one than required detonator sector connector 1.68E-14 0.01 1.26E-09 1.33E-09 4.80E-09 2.40E-05 6.00E-07 4.39E-06 OL-C-EMULSION Too much cartridged emulsion loaded into holes

4.3-W-DETON-SC+OTH One detonator for each of two sectors connected wrongly to a surface connector of another sector plus one other type of errors 4.3-W-DETON-SC+OTH One detonator for each of two sectors connected wrongly to a surface connector of another sector plus one other type of errors 3.84E-16 AND 4.3-W-DETON-SC 4.3-W-DETON-SC-OTH One error other than one One detonator of each of two detonator of a sector connected wrongly to a sectors connected wrongly to surface connector of another a surface connector of another sector sector 1.33E-11 2.90E-05 AND 2.3-W-DETON-SC 2.2-W-DETON MD-DETON OL-EMULSION P-AD-DETON 2.1-WD 2.4-W-SC MD-SC One detonator of a sector One detonator of a sector One detonator wrongly put Manufacturer defect of one Manufacturer defect of one into one sector which contains detonator such that time surface connector such that connected wrongly to a connected wrongly to a surface connector of another Use of a wrong surface Overcharge of emulsion more surface connector of another Wrong design in time delay of the same time delay delay corresponds to another time delay corresponds to one detonator detonator another one than required sector connector sector 1.33E-09 0.01 1.26E-09 1.68E-14 4.80E-09 2.40E-05 6.00E-07 4.39E-06 OL-C-EMULSION Too much cartridged emulsion loaded into holes 4.39E-06

4.4-W-SC+OTH Use of two wrong surface connector plus one other types of errors 4.4-W-SC+OTH Use of two wrong surface connector plus one other type of errors 1.39E-15 AND 4.4-W-SC 4.4-W-SC-OTH Use of two wrong surface One error other than use of a connector wrong surface connector 4.80E-11 2.90E-05 AND 2.4-W-SC P-AD-SC 2.1-WD 2.2-W-DETON 2.3-W-DETON-SC MD-DETON MD-SC OL-EMULSION Manufacturer defect of one One detonator wrongly put One detonator of a sector Manufacturer defect of one surface connector such that detonator such that time into one sector which contain connected wrongly to a Use of a wrong surface Use of a wrong surface Wrong design in time delay of the same time delay surface connector of another delay corresponds to another time delay corresponds to Overcharge of emulsion more connector connector one detonator detonator sector another one than required 1.33E-09 6.00E-07 4.80E-09 0.01 1.26E-09 1.68E-14 2.40E-05 4.39E-06 OL-C-EMULSION Too much cartridged emulsion loaded into holes 4.39E-06

loaded into holes

4.39E-06

4MD-DETON+OTH Incorrect time default of two detonator due to manufacturer defect plus one other type of errors 4MD-DETON+OTH Incorrect time default of two detonator due to manufacturer defect plus one other type of errors 1.20E-12 AND 4MD-DETON MD-DETON-OTH Incorrect time default of two One error other than incorrect detonator due to time default of one detonator manufacturer defect due to manufacturer defect 2.40E-07 4.99E-06 AND MD-DETON P-AD-DETON 2.1-WD 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC MD-SC OL-EMULSION Manufacturer defect of one Manufacturer defect of one One additional detonator One detonator wrongly put One detonator of a sector detonator such that time wrongly put into one sector into one sector which contains connected wrongly to a surface connector such that delay corresponds to another which contains the same time Wrong design in time delay of the same time delay surface connector of another Use of a wrong surface time delay corresponds to Overcharge of emulsion more delay detonator one detonator detonator another one than required sector connector 1.68E-14 2.40E-05 0.01 1.26E-09 1.33E-09 4.80E-09 6.00E-07 4.39E-06 OL-C-EMULSION Too much cartridged emulsion

Too much cartridged emulsion

4.39E-06

loaded into holes

4MD-SC+OTH Two surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors 4MD-DETON+OTH Two surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors 1.70E-13 AND 4MD-SC MD-DETON-OTH Two surface connector fail to One error other than incorrect provide necessary delay due time default of one detonator to manufacturer defect due to manufacturer defect 6.00E-09 2.84E-05 MD-SC P-AD-SC 2.1-WD 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC MD-DETON OL-EMULSION Manufacturer defect of Manufacturer defect of one Manufacturer defect of one One detonator wrongly put One detonator of a sector surface connector such that surface connector such that into one sector which contains connected wrongly to a oneDETONATOR such that time delay corresponds to time delay corresponds to Wrong design in time delay of the same time delay surface connector of another Use of a wrong surface time delay corresponds to Overcharge of emulsion more another one another one one detonator detonator another one than required sector connector 1.68E-14 2.40E-05 6.00E-07 0.01 1.26E-09 1.33E-09 4.80E-09 4.39E-06 OL-C-EMULSION

4MIC-COMB-2

4 MIC detonated (due to same error occurred two times and one other error) at the same time

4MIC-COMB-2

4 MIC detonated (due to same error occurred two times and one other error) at the same time

1.37E-12

OR

4.1-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors

3.65E-16

4.2-W-DETON+OTH

Two detonator wrongly put into one sector which contains tha same time delay detonator plus one other type of errors

4.86E-21

4.3-W-DETON-SC+OTH

One detonator for each of two sectors connected wrongly to a surface connector of another sector plus one other type of errors

3.84E-16

4.4-W-SC+OTH

Use of two wrong surface connector plus one other type of errors

1.39E-15

4MD-DETON+OTH

Incorrect time default of two detonator due to manufacturer defect plus one other type of errors

1.20E-12

4MD-SC+OTH

Two surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors

1.70E-13

4.2-(WD)-W-DETON+OTH

One detonator wrongly put into one sector which containes the same time delay detonator plus one other type of errors except wrong design in time delay

4.2-(WD)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except wrong design in time delay

4.86E-19

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4.2-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

2.90E-05

OR

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09 MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.3-(WD)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except wrong design in time delay

4.3-(WD)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except wrong design in time delay

3.84E-14

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

4.3-(WD)-W-DETON-OTH

One error other than one detonator for a sector connected wrongly to a surface connector of another sector

2.90E-05

ΛÞ

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.4(WD)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except wrong design in time delay

4.4-(WD)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except wrong design in time delay

1.39E-13

AND

2.4-W-SC

Use of a wrong surface connector 4.80E-09

4.4-(WD)-W-SC-OTH

One error other than use of a wrong surface connector

2.90E-05

)R

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(WD)-MD-DETON+OTH

4MIC-(WD)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacuturer defect plus one other type of errors except wrong design in time delay

Incorrect time default of one
detonator due to manufacuturer
defect plus one other type of errors
except wrong design in time delay

1.20E-10

AND

4MD-DETON

Incorrect time default of one detonator due to maufacturer defect

2.40E-05

4(WD)-MD-DETON-OTH
One error other than incorrect time

default of 1 detonator due to manufacturer defect

4.99E-06

1.68E-14

ΩP

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector
4.80E-09

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(WD)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except wrong design in time delay

4(WD)-M	D-SC+OTH
One surfa	ace connector fail to provide
necessary	y delay due to manufacture
defect pl	us one other type of errors
except w	rong design in time delay
	1.70E-1
AND	
4MD-SC	
4MD-SC	ace connector fail to provid
4MD-SC One surfa	ace connector fail to provider delay due to manufacture
4MD-SC One surfa	

4(WD)-MD-SC-OTH

One error other than incorrect time default of one detonator due to manufacturer defect

2.84E-05

OR

MD-SC
Manufacturer defect of one surface connector such that time delay corresponds to another one
6.00E-07

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

Use of a wrong surface connector
4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

Overcharge of emulsion more than required 4.39E-06

OL-EMULSION

OL-C-EMULSION
Too much cartridged emulsion
loaded into holes
4.39E-06

loaded into holes

4.39E-06

corresponds to another one

6.00E-07

corresponds to another one

2.40E-05

4(WD)-OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error except wrong design in time delay of one detonator 4(WD)-OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error except wrong design in time delay of one detonator 1.08E-10 AND OL-EMULSION 4(WD)-OL-EMULSION-OTH Overcharge of emulsion more than required One error other than hole overload 4.39E-06 2.46E-05 OL-C-EMULSION 2.2-W-DETON 2.3-W-DETON-SC MD-DETON 2.4-W-SC MD-SC One detonator wrongly put into one One detonator of a sector connected Manufacturer defect of one Manufacturer defect of one surface Too much cartridged emulsion sector which contains the same time wrongly to a surface connector of detonator such that time delay connector such that time delay

1.33E-09

Use of a wrong surface connector

4.80E-09

another sector

1.68E-14

delay detonator

4(WD)+OTH+OTH

Wrong design in time delay of one detonator plus two other type of errors

4(WD)+OTH+OTH Wrong design in time delay of one detonator plus two other

type of errors

3.08E-19

AND

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

4(WD)-OTH-OTH

Two errors other then wrong design in time delay of one detonator

2.45E-10

4.2-(WD)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except wrong design in time delay

4.86E-19

4.3-(WD)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except wrong design in time delay

3.84E-14

4.4-(WD)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except wrong design in time delay

1.39E-13

4MIC-(WD)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacuturer defect plus one other type of errors except wrong design in time delay

1.20E-10

4(WD)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except wrong design in time delay

4(WD)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except wrong design in time delay of one detonator

1.08E-10

Too much cartridged emulsion

4.39E-06

loaded into holes

4.1-(W-DETON)-WD+OTH Wrong design in time delay of one detonator plus one other type of errors except one detonator wrongly put into one sector 4.1-(W-DETON)-WD+OTH Wrong design in time delay of one detonator plus one other type of errors except one detonator wrongly put into one sector 3.65E-14 AND 4.1-(W-DETON)-WD-OTH 2.1-WD Wrong design in time delay of one One error other than one wrong detonator design in time time of one detonator 1.26E-09 2.90E-05 2.3-W-DETON-SC 2.4-W-SC MD-DETON MD-SC OL-EMULSION One detonator of a sector connected Manufacturer defect of one Manufacturer defect of one surface Overcharge of emulsion more than wrongly to a surface connector of detonator such that time delay connector such that time delay another sector Use of a wrong surface connector corresponds to another one corresponds to another one required 1.33E-09 4.80E-09 2.40E-05 6.00E-07 4.39E-06 OL-C-EMULSION

4.3-(W-DETON)-W-DETON-SC+OTH One detonator connected wrongly to a surface connector of another sector plus one other error except one detonator wrongly put into one sector

4.2-(W-DETON)-W-DETON-SC+OTH

One detonator connected wrongly to surface connector of another sector plus one other error except one detonator wrongly put into one sector

3.84E-14

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

4.2-(W-DETON)-W-DETON-SC-OTH

One error other than one detonator for a sector connected wronglyh to a surface connector of another sector 2.90E-05

nρ

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

Maufacturer defect of one surface connector such that time delay corresponds to another one

MD-SC

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

ther type of errors except one detonator wrongly put into one

2.3-W-DETON-SC

another sector

One detonator of a sector connected

1.33E-09

wrongly to a surface connector of

MD-DETON

Manufacturer defect of one

corresponds to another one

4.4-(W-DETON)-W-SC+OTH	Use of one wrong surface connector plus one other
4.4-(W-DETON)-W-SC+OTH	
Use of one wrong surface connector	
plus one other type of errors except	
one detonator wrongly put into one	
1.39E-13	
AND 2.4-W-SC	4.4-(W-DETON)-W-SC-OTH
2.4-VV-3C	One error other than use of a wrong
Use of a wrong surface connector	surface connector
4.80E-09	2.90E-05
	OR
	2.1-WD

Wrong design in time delay od one

1.26E-09

detonator

MD-SC Manufacturer defect of one surface detonator such that time delauy connector such that time delay corresponds to another one 2.40E-05 6.00E-07

Overcharge of emulsion more than required 4.39E-06

OL-EMULSION

OL-C-EMULSION Too much cartridged emulsion loaded into holes 4.39E-06

4(W-DETON)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except one detonator wrongly put into one sector

4(W-DETON)-MD-DETON
Incorrect time default of one
detonator due to manufacturer
defect plus one other type of errors
except one detonator wrongly put
into one sector
1.20E-1

AND

MD-DETON

Incorrect time default of one deonator due to manufacturer defect

2.40E-05

2.1-WD

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

4(W-DETON)-MD-DETON+OTH One error other than incorrect time default of one detonator due to manufacturer defect 4.99E-06

Wrong design in time delay of one detonator

1.26E-09

2.3-W-DETON-SC One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09 MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(W-DETON)-MD-SC+OTH

One surface connector fail to provide necessay delay due to manufacturer defect plus one other type of errors except one detonator wrongly put into one sector

4(W-DETON)-MD-SC+OTH One surface connector fail to provide necessay delay due to manufacturer defect plus one other type of errors except one detonator wrongly put into one sector 1.70E-11 AND

MD-SC One surface connector fail to provide necessary delay due to manufacturer defect

6.00E-07

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4(W-DETON)-MD-SC-OTH

One error other than incorrect time default of one detonator due to manufacturer defect

2.84E-05

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector 1.33E-09 2.4-W-SC

Use of a wrong surface connector 4.80E-09 MD-DETON

Manufacturer defect of one detonator suchh that time delay corresponds to another one

2.40E-05

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(W-DETON)-OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error except 1 detonator wrongy put into one sector which contains the same time delay detonator

4(W-DETON)-OL-EMULSION+OTH					
Overcharge of emulsion more than					
required plus one other type of error					
except 1 detonator wrongly put into					
one sector which contains the same					
time delay detonator					
1.08E-10					
1.08E-10					
AND					
AND	\neg				
OL-EMULSION	4(W-DETON)-OL-EMULSION-OTH				
Overcharge of emulsion more than	4(W BETON) OF EMOLSION OTT				
required	One error other than hole overload				
4.39E-06	2.46E-05				
4.39E-00	2.401-03				
	OR				
OL-C-EMULSION	2.1-WD	2.3-W-DETON-SC	2.4-W-SC	MD-DETON	MD-SC
OL C LIVIOLSICIA	2.1 775	One detonator of a sector connected	2.1 11 35	Manufacturer defect of one	Manufacturer defect of one surface
Too much cartridged emulsion	Wrong design in time delay of one	wrongly to a surface connector of		detonator such that time delay	connector such that time delay
loaded into hole	detonator	another sector	Use of a wrong surface connector	corresponds to another one	corresponds to another one
4.39E-06	1.26E-09	1.33E-09	4.80E-09	2.40E-05	6.00E-07
4.332-00	1.201-09	1.331-03	4.80L-03	2.40L-03	0.00L-07

4(W-DETON)+OTH+OTH

One detonator wronly put into one sector which contains the same time delay detonator plus two other type of errors

4(W-DETON)+OTH+OTH
One detonator wronly put into
one sector which contains the
same time delay detonator
plus two other type of errors

4.11E-24

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4(W-DETON)-OTH-OTH

Two errors other than one detonator wrongly put into one sector which contains the same time delay detonator

2.45E-10

)R

4.1-(W-DETON)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except one detonator wrongly put into one sector

3.65E-14

4.3-(W-DETON)-W-DETON-SC+OTH

One detonator connected wrongly to surface connector of another sector plus one other error except one detonator wrongly put into one sector

3.84E-14

4.4-(W-DETON)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except one detonator wrongly put into one

1.39E-13

4(W-DETON)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except one detonator wrongly put into one sector

1.20E-10

4(W-DETON)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except one detonator wrongly put into one sector

1.70E-11

4(W-DETON)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except 1 detonator wrongly put into one sector which contains the same time delay detonator

1.08E-10

loaded into hole

4.1-(W-DETON-SC)-WD+OTH	Wrong design in time delay of one detonator plus on	e other type of errors except use of a wrong sur	face connector		
4.1-(W-DETON-SC)-WD+OTH Wrong design in time delay of one					
detonator plus one other type of					
errors except use of a wrong surface					
connector					
3.65E-1	4				
AND					
AND					
2.1-WD	4.1-(W-DETON-SC)-WD-OTH				
2.1 475	One error other than one wrong				
Wrong design in time delay of one	design in time delay of one				
detonator	detonator				
1.26E-0					
	OR				
	2.2-W-DETON	2.4-W-SC	MD-DETON	MD-SC	OL-EMULSION
	One detonator wrongly put into one		Manufacturer defect of one	Manufacturer defect of one surface	
	sector which contains the same time		detonator such that time delay	connector such that time delay	Overcharge of emulsion more than
	delay detonator	Use of a wrong surface connector	corresponds to another one	corresponds to another one	required
	1.68E-14	4.80E-09	2.40E-05	6.00E-07	4.39E-0
					OL-C-EMULSION
					Too much cartridged emulsion

4.2-(W-DETON-SC)-W-DETON+OTH One detonator wrongly put into the sector which contains the same time delay detonator plus one other yupe of errors except one detonator connected wrongly to a surface connector

4.2-(W-DETON-SC)-W-DETON+OTH One detonator wrongly put into the sector which contains the same time delay detonator plus one other yupe of errors except one detonator connected wrongly to a surface connector 4.86E-19

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4.2-(W-DETON-SC)-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.90E-05

2.4-W-SC

Use of a wrong surface connector 4.80E-09 MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.4-(W-DETON-SC)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors exceot one detonator connected wrongly to a surface connector

4.4-(W-DETON-SC)-W-SC+OTH
4.4-(W-DETON-SC)-W-SC+OTH
Use of one wrong surface connector
plus one other type of errors exceot
one detonator connected wrongly to
a surface connector
1.39E-13
AND
2.4-W-SC
Use of a wrong surface connector
4.80E-09

4.4-(W-DETON-SC)-W-SC-OTH

One error other than use of a wrong surface connector

2.90E-05

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

MD-DETON

Manufacturer defect of one
detonator such that time delay
corresponds to another one

2.40E-05

MD-SC
Manufacturer defect of one surface connector such that time delay corresponds to another one
6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION
Too much cartridged emulsion
loaded into hole
4.39E-06

4(W-DETON-SC)-MD-DETON+OTH Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except one detonator connected wrongly to a surface connector

4(W-DETON-SC)-MD-DETON+OTH
Incorrect time default of one
detonator due to manufacturer
defect plus one other type of errors
except one detonator connected
wrongly to a surface connector
1.20E-10
AND

MD-DETON

Incorrect time default of one detonator due to maufacturer defect 2.40E-05

MD-DETON Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

4(W-DETON-SC)-MD-DETON-OTH One error other than incorrect time default of one detonator due to manufacturer defect 4.99E-06

2.2-W-DETON 2.1-WD One detonator wrongly put into one Wrong design in time delay of one sector which contains the same time detonator delay detonator 1.26E-09

2.4-W-SC Use of a wrong surface connector 1.68E-14

4.80E-09

MD-SC Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07

Overcharge of emulsion more than required 4.39E-06

OL-EMULSION

OL-C-EMULSION Too much cartridged emulsion loaded into holes 4.39E-06

4(W-DETON-SC)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except one detonator connected wrongly to a surface connector

4(W-DETON-SC)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except one detonator connected wrongly to a surface connector

1.70E-11

AND

MD-SC

One surface connector fail to provide necessary delay due to manufacturer defect

6.00E-07

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4(W-DETON-SC)-MD-SC-OTH

One error other than incorrect time default of one detonator due to manufacturer defect

2.84E-05

OR

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

Manufacturer defect of one detonator suchh that time delay corresponds to another one

MD-DETON

2.40E-05

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(W-DETON-SC)-OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error except one detonator of a sector connected wrongly to a surface connector of another sector

4(W-DETON-SC)-OL-EMULSION+OTH
Overcharge of emulsion more than
required plus one other type of error
except one detonator of a sector
connected wrongly to a surface
connector of another sector
1.08E-10
AND

Overcharge of emulsion more than

4.39E-06

OL-EMULSION

required

4(W-DETON-SC)-OL-EMULSION-OTH

One error other than hole overload

2.46E-05

OL-C-EMULSION

Too much cartridged emulsion loaded into hole

4.39E-06

Wrong design in time delay of one detonator 1.26E-09

2.1-WD

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.4-W-SC

It into one same time

Use of a wrong surface connector

4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC
Manufacturer defect of one surface connector such that time delay corresponds to another one
6.00E-07

4(W-DETON-SC)+OTH+OTH One detonator connected wrongly to a surface connector of another sector plus two other type of errors

4(W-DETON-SC)+OTH+OTH
One detonator connected
wrongly to a surface connector
of another sector plus two
other type of errors

3.24E-19

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

4(W-DETON-SC)-OTH-OTH
Two errors other than one
detonator of a sector
connected wrongly to a
surface connector of another

2.45E-10

)R

sector

4.1-(W-DETON-SC)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except use of a wrong surface connector

3.65E-14

4.2-(W-DETON-SC)-W-DETON+OTH

One detonator wrongly put into the sector which contains the same time delay detonator plus one other yupe of errors except one detonator connected wrongly to a surface connector

4.86E-19

4.4-(W-DETON-SC)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors exceot one detonator connected wrongly to a surface connector

1.39E-13

4(W-DETON-SC)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except one detonator connected wrongly to a surface connector

1.20E-10

4(W-DETON-SC)-MD-SC+OTH
One surface connector fail to

provide necessary delay due to manufacturer defect plus one other type of errors except one detonator connected wrongly to a surface connector

1.70E-11

4(W-DETON-SC)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except one detonator of a sector connected wrongly to a surface connector of another sector

1.08E-10

4.1-(W-SC)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except use of a wrong surface connector

4.1-(W-SC)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except use of a wrong surface connector

3.65E-14

AND

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

4.1-(W-SC)-WD-OTH

One error other than one wrong design in time delay of one detonator

2.90E-05

OR

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.2-(W-SC)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except use of a wrong surface connector

4.2-(W-SC)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except use of a wrong surface connector

4.86E-19

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4.2-(W-SC)-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

2.90E-05

OR

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.3-(W-SC)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except use of a wrong surface connector

4.3-(W-SC)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except use of a wrong surface connector

3.84E-14

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

4.3-(W-SC)-W-DETON-SC-OTH

One error other than one detonator for a sector connected wrongly to a surface connector of another sector

2.90E-05

ΛD

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(W-SC)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except use of a wrong surface connector

4(W-SC)-MD-DETON+OTH
Incorrect time default of one
detonator due to manufacturer
defect plus one other type of errors
except use of a wrong surface
connector
1.20E-10

AND

Incorrect time default of one detonator due to maufacturer defect

2.40E-05

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

4(W-SC)-MD-DETON-OTH
One error other than incorrect time default of one detonator due to manufacturer defect
4.99E-06

O D

2.1-WD
Wrong design in time delay of one detonator
1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-SC
Manufacturer defect of one surface connector such that time delay corresponds to another one
6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION
Too much cartridged emulsion
loaded into holes
4.39E-06

4(W-SC)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except use of a wrong surface connector

4(W-SC)-MD-SC+O	TH
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One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except use of a wrong surface connector

1.70E-11

AND

MD-SC

One surface connector fail to provide necessary delay due to manufacturer defect

6.00E-07

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4(W-SC)-MD-SC-OTH

One error other than incorrect time default of one detonator due to manufacturer defect

2.84E-05

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(W-SC)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except use of a wrong surface connector

4(W-SC)-OL-EMULSION+OTH
Overcharge of emulsion more than
required plus one other type of error
except use of a wrong surface
connector

1.08E-10

AND

OL-EMULSION
Overcharge of emulsion more than required

4.39E-06

4(W-SC)-OL-EMULSION-OTH

One hole other than hole overload 2.46E-05

OL-C-EMULSION

Too much cartridged emulsion loaded into hole 4.39E-06

2.1-WD

Wrong design in time delay of one detonator 1.26E-09

one

One detonator wrongly put into one sector which contains the same time delay detonator

2.2-W-DETON

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

Manufacturer defect of one detonator such that time delay corresponds to another one

MD-DETON

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4(W-SC)+OTH+OTH

Use of a wrong surface connector plus two other type of errors

4(W-SC)+OTH+OTH Use of a wrong surface connector plus two other type of errors

1.17E-18

AND

2.4-W-SC

Use of a wrong surface connector

4.80E-09

4(W-SC)-OTH-OTH Two errors other than use of a wrong surface connector

2.45E-10

4.1-(W-SC)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except use of a wrong surface connector 3.65E-14

4.2-(W-SC)-W-DETON+OTH One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except use of a wrong surface connector

4.86E-19

One detonator connected wrongly to a surface connector of another sector plus one other error except use of a wrong surface connector 3.84E-14

4.3-(W-SC)-W-DETON-SC+OTH

4(W-SC)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except use of a wrong surface connector 1.20E-10 4(W-SC)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except use of a wrong surface connector 1.70E-11 4(W-SC)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except use of a wrong surface connector 1.08E-10

4.1-(MD-DETON)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except manufacturer defect of one detonator

C 20E 4E
one detonator
errors except manufacturer defect of
detonator plus one other type of
Wrong design in time delay of one
4.1-(MD-DETON)-WD+OTH

6.29E-15

AND

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

4.1-(MD-DETON)-WD-OTH
One error other than one wrong

design in time delay of one detonator

4.99E-06

OR

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.2-(MD-DETON)-W-DETON+OTH One detonator wrongly put

One detonator wrongly put into the sector which contains the same time delay detonator plus one other type of errors except manufacturer defect of one detonator

4.2-(MD-DETON)-W-DETON+OTH

One detonator wrongly put into the sector which contains the same time delay detonator plus one other type of errors except manufacturer defect of one detonator

8.37E-20

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4.2-(MD-DETON)-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

4.99E-06

ΛÞ

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.3-(MD-DETON)-W-DETON-SC+OTH One detonator connected wrongly to a surface connector of another sector plus one other error except manufacturer defect of one detonator

4.3-(MD-DETON)-W-DETON-SC+OTH
One detonator connected wrongly to a surface connector of another sector plus one other error except manufacturer defect of one detonator

6.61E-15

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

4.3-(MD-DETON)-W-DETON-SC-OTH
One error other than one detonator for a sector connected wrongly to a surface connector of another sector

4.99E-06

OR

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.4-W-SC

Use of a wrong surface connector 4.80E-09 MD-SC

connector such that time delay corresponds to another one 6.00E-07

Maufacturer defect of one surface

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.4-(MD-DETON)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except manufacturer defect of one detonator

4.4-(MD-DETON)-W-SC+OTH	İ
Use of one wrong surface connector	İ
plus one other type of errors except	İ
manufacturer defect of one	İ
detonator	İ
2.39E-14	İ
AND	
2.4-W-SC	Í
	İ
Use of a wrong surface connector	ì

4.80E-09

4.4-(MD-DETON)-W-SC-OTH

One error other than use of a wrong surface connector

4.99E-06

2.1-WD
Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.4-W-SC
One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-SC
Manufacturer defect of one surface connector such that time delay corresponds to another one
6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION
Too much cartridged emulsion
loaded into hole
4.39E-06

4(MD-DETON)-MD-SC+OTH

4(MD-DETON)-MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except manufacuturer defect of one detonator

One surface connector fail to provide
necessary delay due to manufacturer
defect plus one other type of errors

except manufacuturer defect of one detonator

2.64E-12

AND

MD-SC

One surface connector fail to provide necessary delay due to manufacturer defect

6.00E-07

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4(MD-DETON)-MD-SC-OTH

One error other than incorrect time default of one detonator due to manufacturer defect

4.39E-06

OR

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

OL-EMULSION

required

Use of a wrong surface connector 4.80E-09

2.4-W-SC

4.39E-06

Overcharge of emulsion more than

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4(MD-DETON)-OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error except manufacturer defect of one detonator such that time delay corresponds to another one

4(MD-DETON)-OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error except manufacturer defect of one detonator such that time delay corresponds to another one 2.66E-12 AND OL-EMULSION 4(MD-DETON)-OL-EMULSION-OTH Overcharge of emulsion more than required One hole other than overload 4.39E-06 6.07E-07 OL-C-EMULSION 2.1-WD 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC MD-SC One detonator wrongly put into one One detonator of a sector connected Manufacturer defect of one surface sector which contains the same time Too much cartridged emulsion Wrong design in time delay of one wrongly to a surface connector of connector such that time delay detonator corresponds to another one loaded into hole delay detonator another sector Use of a wrong surface connector 4.39E-06 1.26E-09 1.68E-14 1.33E-09 4.80E-09 6.00E-07

4(MD-DETON)+OTH+OTH

Manufacturer defect of one detonator such that time delay corresponds to another one plus two other type of errors

4(MD-DETON)+OTH+OTH Manufacturer defect of one detonator such that time delay corresponds to another one plus two other type of errors

1.28E-16

AND

MD-DETON

Incorrect time default of one detonator due to maufacturer defect

2.40E-05

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another 2.40E-05 4(MD-DETON)-OTH-OTH

Two errors other than manufacturer defect of one detonator such that time delay corresponds to another

5.34E-12

4.1-(MD-DETON)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except manufacturer defect of one detonator 6.29E-15 One detonator wrongly put into the sector which contains the same time delay detonator plus one other type of errors except manufacturer defect of one

8.37E-20

4.2-(MD-DETON)-W-DETON+OTH

detonator

4.3-(MD-DETON)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except manufacturer defect of one detonator 6.61E-15

4.4-(MD-DETON)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except manufacturer defect of one detonator 2.39E-14 4(MD-DETON)-MD-SC+OTH One surface connector fail to

provide necessary delay due to manufacturer defect plus one other type of errors except manufacuturer defect of one detonator

2.64E-12

4(MD-DETON)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except manufacturer defect of one detonator such that time delay corresponds to another one

2.66E-12

4.1-(MD-SC)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except manufacturer defect of one surface connector

4.1-((MD-SC)	-WD+OTH
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Wrong design in time delay of one detonator plus one other type of errors except manufacturer defect of one surface connector

3.58E-14

AND

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

4.1-(MD-SC)-WD-OTH

One error other than one wrong design in time delay of one detonator

2.84E-05

OR

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector
4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.2-(MD-SC)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except manufacturer defect of one surface connector

4.2-(MD-SC)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except manufacturer defect of one surface connector

4.76E-19

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4.2-(MD-SC)-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

2.84E-05

ΛÞ

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09 MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

OL-C-EMULSION

loaded into holes

Too much cartridged emulsion

4.39E-06

4.3-(MD-SC)-W-DETON-SC+OTH One detonator connected wrongly to a surface connector of another sector plus one other error except manufacturer defect of one surface connector 4.3-(MD-SC)-W-DETON-SC+OTH One detonator connected wrongly to a surface connector of another sector plus one other error except manufacturer defect of one surface connector 3.76E-14 AND 4.3-(MD-SC)-W-DETON-SC-OTH 2.3-W-DETON-SC One detonator of a sector connected One error other than one detonator wrongly to a surface connector of for a sector connected wrongly to a surface connector of another sector another sector 1.33E-09 2.84E-05 2.2-W-DETON MD-DETON OL-EMULSION 2.1-WD 2.4-W-SC One detonator wrongly put into one Manufacturer defect of one Overcharge of emulsion more than Wrong design in time delay of one sector which contains the same time detonator such that time delay detonator delay detonator Use of a wrong surface connector corresponds to another one required 1.26E-09 1.68E-14 4.80E-09 2.40E-05 4.39E-06

loaded into hole

4.4-(MD-SC)-W-SC+OTH	Use of one wrong surface connector plus one other t	type of errors except manufacturer defect of one	e surface connector		
4.4-(MD-SC)-W-SC+OTH					
Use of one wrong surface connector	•				
plus one other type of errors except					
manufacturer defect of one surface					
connector					
1.36E-1	3				
AND					
AND					
2.4-W-SC	4.4-(MD-SC)-W-SC-OTH				
	One error other than use of a wrong				
Use of a wrong surface connector	surface connector				
4.80E-0					
	OR				
	2.1-WD	2.2-W-DETON	2.3-W-DETON-SC	MD-DETON	OL-EMULSION
		One detonator wrongly put into one	One detonator of a sector connected	Manufacturer defect of one	
	Wrong design in time delay of one	sector which contains the same time	wrongly to a surface connector of	detonator such that time delay	Overcharge of emulsion more than
	detonator	delay detonator	another sector	corresponds to another one	required
	1.26E-09	1.68E-14	1.33E-09	2.40E-05	4.39E-0
					OL-C-EMULSION
					Too much cartridged emulsion

loaded into holes

4.39E-06

4(MD-SC)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except manufacturer defect of one surface connector

incorrect time detault of one detonator due to mand	macturer defect plus one other type or errors ex	tept manufacturer defect of one surface connect	.01	
\neg				
7				
.0				
A/MD SC\ MD DETON OTH				
4.331-00				
OR		1		
2.1-WD	2.2-W-DETON	2.3-W-DETON-SC	2.4-W-SC	OL-EMULSION
Wrong design in time delay of one				Overcharge of emulsion more than
			Use of a wrong surface connector	required
			4.80E-09	4.39E-0
				OL-C-EMULSION
				Too much cartridged emulsion
	4(MD-SC)-MD-DETON-OTH One error other than incorrect time default of one detonator due to manufacturer defect OR 2.1-WD Wrong design in time delay of one detonator	4(MD-SC)-MD-DETON-OTH One error other than incorrect time default of one detonator due to manufacturer defect 4.39E-06 OR 2.1-WD 2.2-W-DETON One detonator wrongly put into one sector which contains the same time delay detonator delay detonator	4(MD-SC)-MD-DETON-OTH One error other than incorrect time default of one detonator due to manufacturer defect 4.39E-06 OR 2.1-WD One detonator wrongly put into one wrongly to a surface connected wrongly to a surface connector of delay detonator delay detonator Description on the delay of one detonator of another sector of another	4(MD-SC)-MD-DETON-OTH One error other than incorrect time default of one detonator due to manufacturer defect 4.39E-06 OR 2.1-WD One detonator wrongly put into one wrongly put into one sector which contains the same time detonator detonator Wrong design in time delay of one detonator delay detonator detonator Use of a wrong surface connector

4(MD-SC)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except manufacturer defect of one surface connector such that time delay corresponds to another one

4(MD-SC)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except manufacturer defect of one surface connector such that time delay corresponds to another one

1.05E-10

AND

OL-EMULSION
Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into hole

4.39E-06

4(MD-SC)-OL-EMULSION-OTH

One error other than hole overload

OR

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.40E-05

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

Use of a wrong surface connector 4.80E-09

2.4-W-SC

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

4(MD-SC)+OTH+OTH

Manufacturer defect of one surface connector such that time delay corresponds to another one plus two other type of error

4(MD-SC)+OTH+OTH

Manufacturer defect of one surface connector such that time delay corresponds to another one plus two other type of error

1.27E-16

AND

MD-SC

One surface connector fail to provide necessary delay due to manufacturer defect

6.00E-07

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07

4(MD-SC)-OTH-OTH

Two errors other than manufacturer defect of one detonator such that time delay corresponds to another one

2.11E-10

OR

4.1-(MD-SC)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except manufacturer defect of one surface connector

3.58E-14

4.2-(MD-SC)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except manufacturer defect of one surface connector

4.76E-19

4.3-(MD-SC)-W-DETON-SC+OTH

One detonator connected wrongly to a surface connector of another sector plus one other error except manufacturer defect of one surface connector

3.76E-14

4.4-(MD-SC)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except manufacturer defect of one surface connector 1.36E-13

4(MD-SC)-MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors except manufacturer defect of one surface connector

1.05E-10

4(MD-SC)-OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of error except manufacturer defect of one surface connector such that time delay corresponds to another one

1.05E-10

4.1-(OL-EMULSION)-WD+OTH Wrong design in time delay of one detonator plus one other type of errors except overcharge 4.1-(OL-EMULSION)-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors except overcharge

3.10E-14

AND

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

4.1-(OL-EMULSION)-WD-OTH
One error other than one wrong design in time delay of one detonator

2.46E-05

OR

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4.2-(OL-EMULSION)-W-DETON+OTH One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except overcharge

4.2-(OL-EMULSION)-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors except overcharge

4.12E-19

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

4.2-(OL-EMULSION)-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

2.46E-05

OR

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

4.3-(OL-EMULSION)-W-DETON-SC+OTH One detonator connected wrongly to a surface connector of another sector plus one other error except overcharge

4.3-(OL-EMULSION)-W-DETON-SC+OTH					
4.5 (OE EMOESION) W BETON SCIOTI					
One detonator connected wrongly to a					
surface connector of another sector plus					
one other error except overcharge					
3.26E-14					
AND					
2.3-W-DETON-SC	4.3-(OL-EMULSION)-W-DETON-SC-OTH				
One detonator of a sector connected	One error other than one detonator for a				
wrongly to a surface connector of another	sector connected wrongly to a surface				
sector	connector of another sector				
1.33E-09	2.46E-05				
	OR				
	2.1-WD	2.2-W-DETON	2.4-W-SC	MD-DETON	MD-SC
		One detonator wrongly put into one		Manufacturer defect of one	Manufacturer defect of one surface
	Wrong design in time delay of one	sector which contains the same time		detonator such that time delay	connector such that time delay
	detonator	delay detonator	Use of a wrong surface connector	corresponds to another one	corresponds to another one
	1.26E-09	1.68E-14	4.80E-09	2.40E-05	6.00E-0

4.4-(OL-EMULSION)-W-SC+OTH

Use of one wrong surface connector plus one other type of errors except overcharge

4.4-(OL-EMULSION)-W-SC+OTH
Use of one wrong surface connector
plus one other type of errors except
overcharge
1 105 12

1.18E-13

AND

2.4-W-SC

Use of a wrong surface connector

4.80E-09

4.4-(OL-EMULSION)-W-SC-OTH One error other than use of a wrong surface connector 2.46E-05

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.2-W-DETON One detonator wrongly put into one sector which contains the same time delay detonator 1.68E-14 2.3-W-DETON-SC One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

MD-DETON Manufacturer defect of one detonator such that time delay corresponds to another one 2.40E-05 MD-SC Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07 corresponds to another one

2.40E-05

MD-SC

Use of a wrong surface connector

4.80E-09

Manufacturer defect of one surface

6.00E-07

connector such that time delay

corresponds to another one

4(OL-EMULSION)-MD-DETON+OTH Incorrect time default of one detonator due to manufacturer defect plus one other type of errorss except overcharge

1.26E-09

4(OL-EMULSION)-MD-DETON+OTH Incorrect time default of one detonator due to manufacturer defect plus one other type of errorss except overcharge 1.46E-11 AND MD-DETON 4(OL-EMULSION)-MD-DETON-OTH One error other than incorrect time default of one detonator due to Incorrect time default of one detonator due to maufacturer defect manufacturer defect 2.40E-05 6.07E-07 MD-DETON 2.1-WD 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC Manufacturer defect of one One detonator wrongly put into one One detonator of a sector connected detonator such that time delay sector which contains the same time Wrong design in time delay of one wrongly to a surface connector of

delay detonator

another sector

1.33E-09

1.68E-14

detonator

connector such that time delay corresponds to another one

6.00E-07

detonator such that time delay

2.40E-05

corresponds to another one

Use of a wrong surface connector

4.80E-09

4(OL-EMULSION)-MD-SC+OTH One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except overcharge 4(OL-EMULSION)-MD-SC+OTH One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors except overcharge 1.44E-11 AND 4(OL-EMULSION)-MD-SC-OTH MD-SC One surface connector fail to provide One error other than incorrect time necessary delay due to manufacturer defult of one detonator due to defect manufacturer defect 6.00E-07 2.40E-05 2.3-W-DETON-SC MD-SC 2.1-WD 2.2-W-DETON 2.4-W-SC MD-DETON Manufacturer defect of one surface One detonator wrongly put into one One detonator of a sector connected Manufacturer defect of one

wrongly to a surface connector of

1.33E-09

another sector

sector which contains the same time

1.68E-14

delay detonator

Wrong design in time delay of one

1.26E-09

detonator

Too much cartridged

emulsion loaded into holes

4.39E-06

4(OL-EMULSION)+OTH+OTH Overcharge of emulsion more than required and two other errors occur at the same time

4(OL-EMULSION)+OTH+OTH Overcharge of emulsion more than required and two other errors occur at the same time 1.28E-16 AND 4(OL-EMULSION)-OTH-OTH OL-EMULSION Overcharge of emulsion more Combination of two other than required different types of errors 4.39E-06 2.92E-11 OL-C-EMULSION 4.1-(OL-EMULSION)-WD+OTH 4.2-(OL-EMULSION)-W-DETON+OTH Wrong design in time delay of One detonator wrongly put into one one detonator plus one other sector which contains the same time

type of errors except

3.10E-14

overcharge

4.3-(OL-EMULSION)-W-DETON-SC+OTH 4.4-(OL-EMULSION)-W-SC+OTH

3.26E-14

One detonator connected wrongly to a

one other error except overcharge

delay detonator plus one other type of

4.12E-19

errors except overcharge

surface connector of another sector plus

Use of one wrong surface connector plus one other type of errors except overcharge

4(OL-EMULSION)-MD-DETON+OTH Incorrect time default of one detonator due to manufacturer defect plus one other type of errorss except overcharge 1.46E-11 4(OL-EMULSION)-MD-DETON+OTH Incorrect time default of one detonator due to manufacturer defect plus one other type of errorss except overcharge 1.44E-11

4MIC-COMB-3

4 MIC detonated (due to three different errors occur at the same time) at the same time

4MIC-COMB-3

4 MIC detonated (due to three different errors occur at the same time) at the same time

3.84E-16

OR

4(WD)+OTH+OTH

Wrong design in time delay of one detonator plus two other type of errors

3.08E-19

4(W-DETON)+OTH+OTH

One detonator wronly put into one sector which contains the same time delay detonator plus two other type of errors

4.11E-24

4(W-DETON-SC)+OTH+OTH

One detonator connected wrongly to a surface connector of another sector plus two other type of errors

3.24E-19

4(W-SC)+OTH+OTH

Use of a wrong surface connector plus two other type of errors

1.17E-18

4(MD-DETON)+OTH+OTH

Manufacturer defect of one detonator such that time delay corresponds to another one plus two other type of errors

1.28E-16

4(MD-SC)+OTH+OTH

Manufacturer defect of one surface connector such that time delay corresponds to another one plus two other type of error

1.27E-16

4(OL-EMULSION)+OTH+OTH

Overcharge of emulsion more than required and two other errors occur at the same time

1.28E-16

4MIC-COMB-4

4 MIC detonated (due to charge overload and one other error occur at the same time) at the same time

ANAIC COMP. A						
4MIC-COMB-4						
4 MIC detonated (due to						
charge overload and one other						
error occur at the same time)						
at the same time						
1.08E-10						
AND						
OL-EMULSION	4MIC-OTH					
Overcharge of emulsion more						
than required	One other type of errors					
4.39E-06	2.46E-05					
	OR					
OL-C-EMULSION	2.1-WD	2.2-W-DETON	2.3-W-DETON-SC	2.4-W-SC	MD-DETON	MD-SC
			One detonator of a sector			Manufacturer defect of one
		1 detonator wrongly put into	connected wrongly to a		Manufacturer defect of one	surface connector such that
Too much cartridged emulsion	Wrong design in time delay of	one sector which containes the	surface connector of another	Use of a wrong surface	detonator such that time delay	time delay corresponds to
loaded into holes	one detonator	same time delay detonator	sector	connector	corresponds to another one	another one
4.39E-06	1.26E-09	1.68E-14	1.33E-09	4.80E-09	2.40E-05	6.00E-07

3.1-WD

Wrong design in time delay of two detonators

3.1-WD	
Wrong design in time delay of	two
detonators	
1	.26E-11

AND

2.1-WD
Wrong design in time delay of one
detonator
1.26E-09

P-AD-DETON
Wrong design in time delay of
additional detonator
1 00F-02

3.2-W-DETON

Two detonator wrongly put into one sector which contains the same time delay detonator

2	1	١,	V-			$\overline{}$	
3.	_	– v	v -	ונו	-	I U	ИΝ

Two detonator wrongly put into one sector which contains the same time delay detonator

1.68E-16

AND

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

1.68E-14

P-AD-DETON

Additional detonator wrongly put into one sector which contains the same time delay detonator

0.01

3.3-W-DETON-SC

Two detonators of othe sectors connected wrongly to a surface connector of another sector

3.3-	vv	-	101	1 2

Two detonators of other sectors connected wrongly to a surface connector of another sector

1.33E-11

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface conector of another sector

1.33E-09

P-AD-SC

Additional detonator of a sector connected wrongly to a surface connector of another sector

0.01

3.4-W-SC Use of two wrong surface connector

2.4.W.SC	
3.4-W-SC	
Use of two wrong surface connector	
4.80E-11	
1.502 11	
AND	
2.4-W-SC	P-AD-SC
	Additional use of wrong surface
Use of wrong surface connector	connector
4.80E-09	0.03

3MD-DETON

Incorrect time default of 2 detonators due to manufacturer defect

3MD-DETON
Incorrect time default of 2
detonators due to manufacturer
defect

2.40E-07

AND

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one

2.40E-05

P-AD-DETON

Manufacturer defect of another detonator such that time delay corresponds to another one

0.01

3MD-SC

Surface connector fails to provide necessary delay due to manufacturer defect

3MD-SC
Surface connector fails to provide
necessary delay due to manufacturer
defect

6.00E-09

AND

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one

6.00E-07

P-AD-SC

Manufacturer defect of another surface connector such that time delay corresponds to another one

0.01

3MIC-ER-COMB

3 MIC detonated at the same time (Due to combination of two types of errors)

3MIC-ER-COMB 3 MIC detonated at the same time (Due to combination of two types of errors)

2.45E-10

OR

2.1-WD+OTH

Wrong design in time delay of one detonator plus one other type of errors

3.65E-14

2.2-W-DETON+OTH

One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors

4.86E-19

2.3-W-DETON+OTH

One detonator of a sector connected wrongly to a surface connector of another sector plus one other type of errors

3.84E-14

2.4-W-SC+OTH

Use of a wrong surface connector plus one other type of errors 1.39E-13 MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors 1.20E-10 MD-SC+OTH

Surface connector fails to provide necessary delay due to manufacturer defect plus one other type of errors 1.70E-11 OL-EMULSION+OTH

Overcharge of emulsion more than required plus one other type of errors

1.08E-10

OL-C-EMULSION

loaded into holes

Too much cartridged emulsion

4.39E-06

3.1-WD+OTH Wrong design in time delay of one detonator plus one other type of errors 3.1-WD+OTH Wrong design in time delay of one detonator plus one other type of errors 3.65E-14 AND 2.1-WD 3.1-WD-OTH One error other than one Wrong design in time delay of wrong design in time delay of one detonator one detonator 1.26E-09 2.90E-05 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC MD-DETON MD-SC OL-EMULSION One detonator of a sector Manufacturer defect of one surface connector such that One detonator wrongly put connected wrongly to a Manufacturer defect of one into one sector which contains surface connector of another detonator such that time delay Overcharge of emulsion more Use of a wrong surface time delay corresponds to the same time delay detonator corresponds to another one another one than required sector connector 4.80E-09 1.68E-14 1.33E-09 6.00E-07 4.39E-06 2.40E-05

3.2-W-DETON+OTH One detonator wrongly put into one sector which contains the same time delay detonator plus one other type of errors

3.2-W-DETON+OTH
One detonator wrongly put
into one sector which contain
tha same time delay detonato
plus one other type of errors
4.86E-1
AND
2 2 11/ 257011

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator 1.68E-14

3.2-W-DETON-OTH

One error other than one detonator wrongly put into a sector which contains the same time delay detonator

2.90E-05

OR

2.1-WD

Wrong design in time delay of one detonator
1.26E-09

2.3-W-DETON-SC
One detonator of a sector connected wrongly to a

surface connector of another sector 1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one 2.40E-05

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

3.3-W-DETON-SC+OTH One detonator of a sector connected wrongly to a surface connector of another sector plus one other type of errors

3.3-W-DETON-SC+OTH One detonator of a sector connected wrongly to a surface connector of another sector plus one other type of errors 3.84E-14

AND

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

3.3-W-DETON-OTH One error other than one

detonator of a sector connected wrongly to a surface connector of another sector

2.1-WD

Wrong design in time delay of one detonator

1.26E-09

2.90E-05

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator 2.4-W-SC

Use of a wrong surface connector 1.68E-14

MD-DETON

4.80E-09

Manufacturer defect of one detonator such that time delay corresponds to another one 2.40E-05 MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07 OL-EMULSION

Overcharge of emulsion more than required

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.39E-06

3.4-W-SC+OTH

Use of a wrong surface connector plus one other types of errors

3.4-W-SC+OTH	
Use of one wrong surface	
connector plus one other type	
of errors	
1.39E-13	
-	
AND	
2.4-W-SC	3.4-W-SC-OTH
Use of a wrong surface	One error other than use of a
connector	wrong surface connector
4.80E-09	2.90E-05
	OR

2.1-WD

Wrong design in time delay of one detonator 1.26E-09

2.2-W-DETON One detonator wrongly put into one sector which contains

the same time delay detonator 1.68E-14 2.3-W-DETON-SC One detonator of a sector

connected wrongly to a surface connector of another sector 1.33E-09 MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one 2.40E-05 MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07 OL-EMULSION

Overcharge of emulsion more than required

4.39E-06

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

3MD-DETON+OTH

Incorrect time default of one detonator due to manufacturer defect plus one other type of errors

3MD-DETON+OTH
Incorrect time default of one detonator due to manufacturer defect plus one other type of errors

1.20E-10

AND

3MD-DETON

Incorrect time default of one detonator due to manufacturer defect

2.40E-05

3MD-DETON-OTH

One error other than incorrect time default of one detonator due to manufacturer defect

4.99E-06

OΒ

MD-DETON

Manufacturer defect of one detonator such that time delay corresponds to another one 2.40E-05

2.1-WD

Wrong design in time delay of one detonator 1.26E-09

2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator 1.68E-14

2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

1.33E-09

2.4-W-SC

Use of a wrong surface connector 4.80E-09

MD-SC

Manufacturer defect of one surface connector such that time delay corresponds to another one 6.00E-07

OL-EMULSION

Overcharge of emulsion more than required

OL-C-EMULSION

Too much cartridged emulsion loaded into holes

4.39E-06

Too much cartridged emulsion

4.39E-06

loaded into holes

3MD-SC+OTH

One surface connector fail to provide necessary delay due to manufacturer defect plus one other type of errors

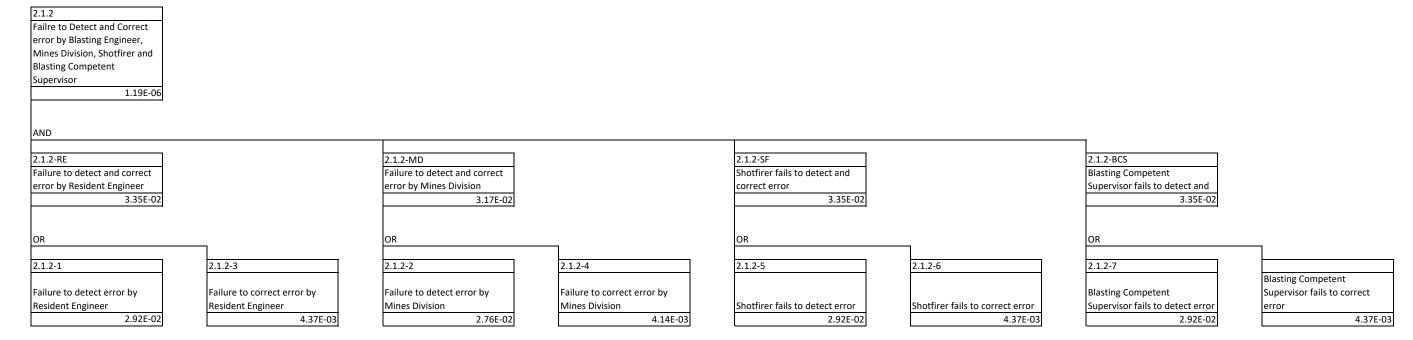
31410-30-0111	ne surface connector fail to provide necessary	y delay due to mandiacturer defect plus of	ne other type of errors			
3MD-DETON+OTH						
One surface connector fail to						
provide necessary delay due to						
manufacturer defect plus one						
other type of errors						
1.70E-11						
AND						
3MD-SC	MD-DETON-OTH					
One surface connector fail to	One error other than incorrect					
provide necessary delay due to	time default of one detonator					
manufacturer defect	due to manufacturer defect					
6.00E-07	2.84E-05					
	OR					
MD-SC	2.1-WD	2.2-W-DETON	2.3-W-DETON-SC	2.4-W-SC	MD-DETON	OL-EMULSION
Manufacturer defect of one			One detonator of a sector		Manufacturer defect of	
surface connector such that		One detonator wrongly put	connected wrongly to a		oneDETONATOR such that	
time delay corresponds to	Wrong design in time delay of	into one sector which contains	surface connector of another	Use of a wrong surface	time delay corresponds to	Overcharge of emulsion more
another one	one detonator	the same time delay detonator	sector	connector	another one	than required
6.00E-07	1.26E-09	1.68E-14	1.33E-09	4.80E-09	2.40E-05	4.39E-06
						OL-C-EMULSION
						OL-C-LIVIOLSION

OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error OL-EMULSION+OTH Overcharge of emulsion more than required plus one other type of error 1.08E-10 AND OL-EMULSION OL-EMULSION-OTH One error other than hole Overcharge of emulsion more than required overload 2.46E-05 4.39E-06 OL-C-EMULSION 2.1-WD 2.2-W-DETON 2.3-W-DETON-SC 2.4-W-SC MD-DETON MD-SC One detonator of a sector Manufacturer defect of one One detonator wrongly put connected wrongly to a Manufacturer defect of one surface connector such that Too much cartridged emulsion into one sector which contains surface connector of another detonator such that time delay time delay corresponds to Wrong design in time delay of Use of a wrong surface the same time delay detonator loaded into holes one detonator corresponds to another one another one sector connector 4.39E-06 6.00E-07 1.26E-09 1.33E-09 4.80E-09 1.68E-14 2.40E-05

2.1.1 Design Error by Blasting Engineer and Failure of Design Check and Correction

2.1.1		
Design Error by Blasting Engineer and		
Failure of Design Check and		
Correction		
1.05E-03		
AND		
2.1.1-1	2.1.1-BE	
	Failure to detect and correct error by	
Design error by Blasting Engineer	Blasting Engineer during modelling	
3.03E-02	3.48E-02	
	OR	
	2.1.1-2	2.1.1-3
	Failure to detect error by Blasting	Failure to correct error by Blasting
	Engineer during modelling	Engineer during modelling
	3.03E-02	4.54E-03

2.1.2 Failure to detect and correct error by Blasting Engineer, Mines Division, Shotfirer and Blasting Competent Supervisor



2.1-WD

Wrong design in time delay of one detonator

2.1-WD	
Wrong design in time delay o	f one
detonator	
	1.26E-09

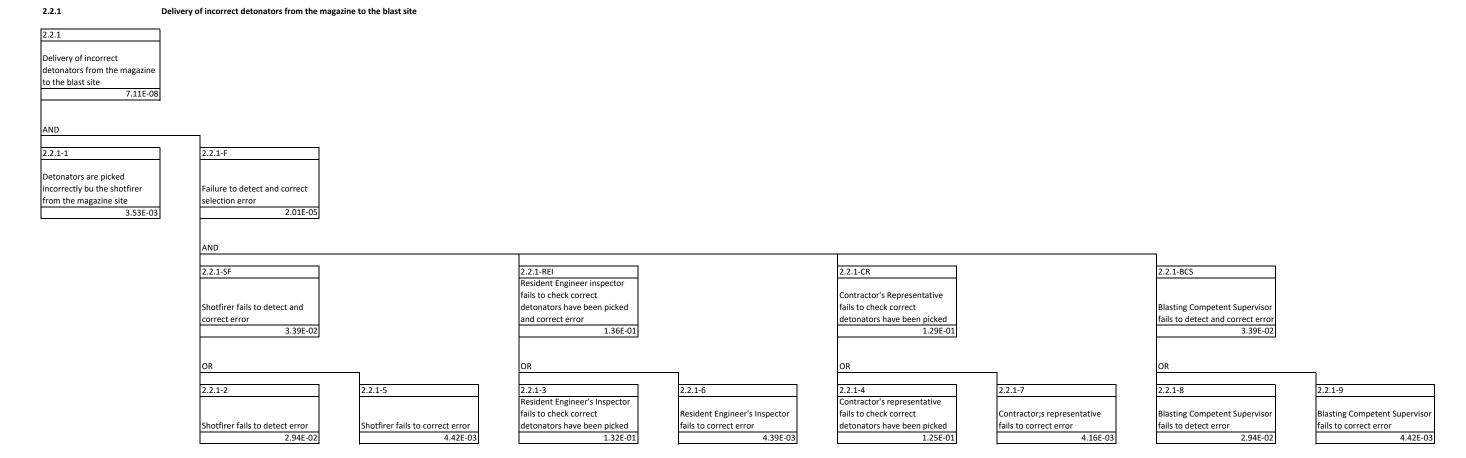
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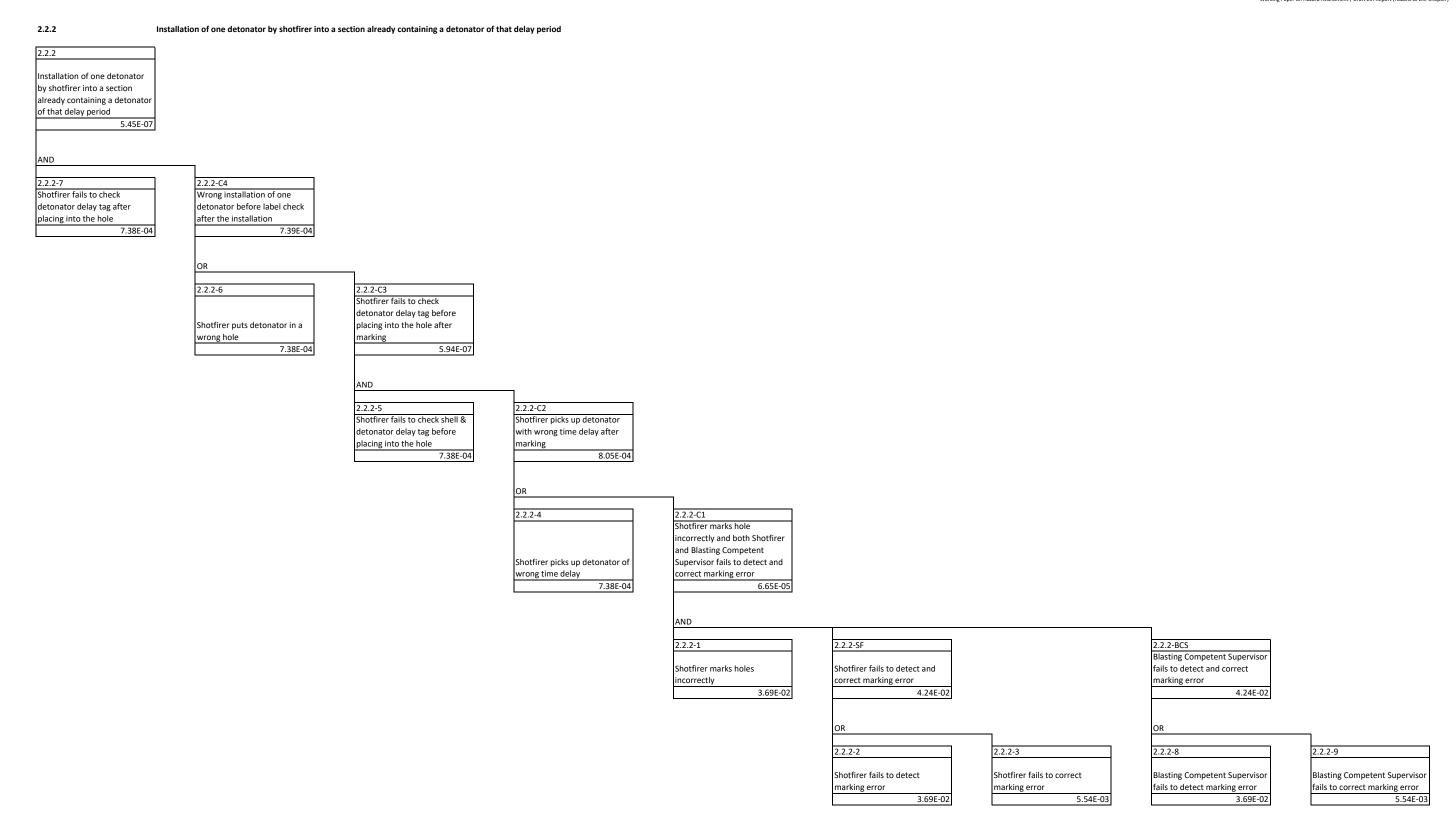
2.1.1
Design Error by Blasting Engineer and
Failure of Design Check and
Correction

1.05E-03

2.1.2 Failure by Resident Engineer and Mines Division to detect and correct design error

1.19E-06





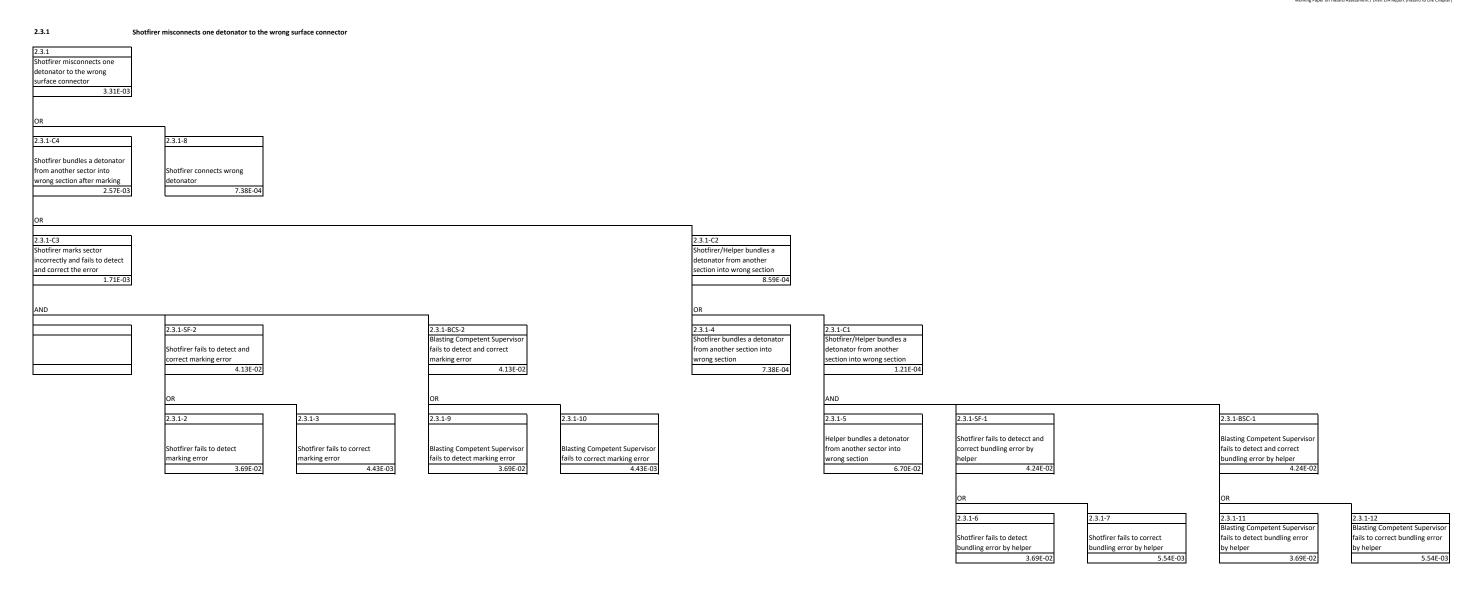
2.2.3 Shotfirer/Blasting Competent Supervisor fails to check and correct installation error

2.2.3			
Shotfirer/Blasting Competent			
Supervisor fails to check and correct			
installation error			
1.80E-03			
AND			
2.2.3-SF		2.2.3-BCS	
		Blasting Competent Supervisor fails	
Shotfirer fails to detect and correct		to detect and correct installation	
installation error of detonator		error of detonator	
4.24E-02		4.24E-02	
OR		OR	
2.2.3-1	2.2.3-2	2.2.3-3	2.2.3-4
Shotfirer leaves empty holes in the			
blast face due to not realising there	Shotfirer fails to fill empty holes	Blasting Competent Supervisor fails	Blasting Competent Supervisor fails
are detonators left over	before detonation	to detect installation error	to correct insallation error
3.69E-02	5.54E-03	3.69E-02	5.54E-03

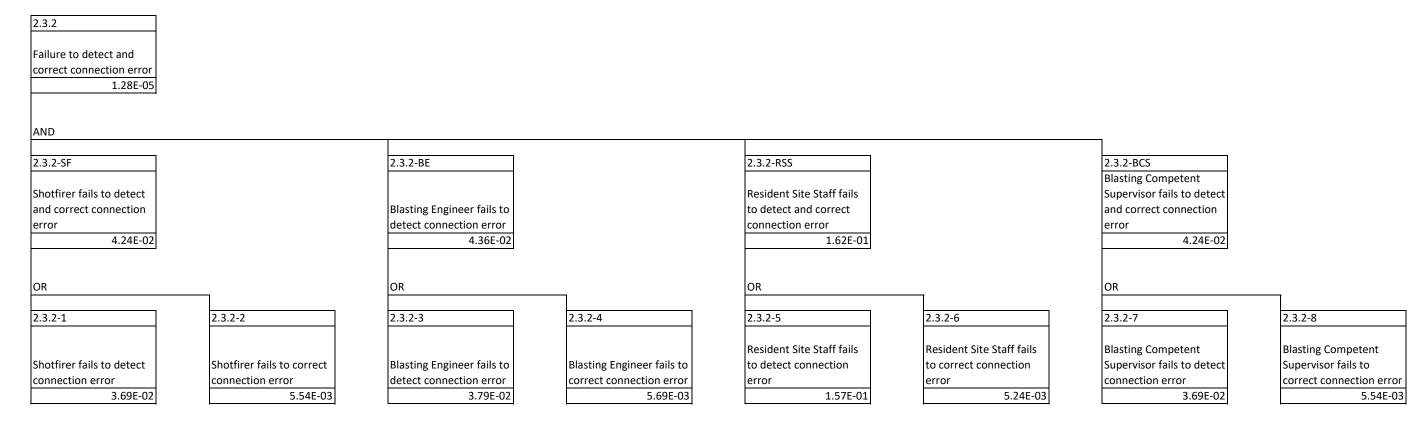
2.2-W-DETON

One detonator wrongly put into one sector which contains the same time delay detonator

2.2-W-DETON		
One detonator wrongly put into one		
sector which contains the same time		
delay detonator		
1.68E-14		
AND		<u></u>
2.2.1	2.2.2	2.2.3
	Installation of One Detonator by	
	Shotfirer into a section already	Shotfirer /Blasting Competent
Delivery of incorrect detonators from	containing a detonator of that delay	Supervisor Fails to Check and Correct
the magazine to the blast site	period	Installation Error
7.11E-08	1.31E-04	1.80E-03



2.3.2 Failure to detect and correct connection error



2.3-W-DETON-SC

One detonator of a sector connected wrongly to a surface connector of another sector

2.3-W-DETON-SC		
One detonator of a sector connected		
wrongly to a surface connector of		
another sector		
1.33E-09		
AND		
2.3.1	2.3.2	2.2.2
		Installation of one detonator by
		Shotfirer into a section already
Shotfirer misconencts one detonator	Failure to detect and correct	containing a detonator of that delay
to the wrong surface connector	connection error	period
7.93E-01	1.28E-05	1.31E-04

the surface connector before

installing

2.4.1 Incorrect Installation of Surface Connector

2.4.1	
Incorrect installation of surface	
connector	
1.48E-03	
OR	
2.4.1-1	2.4.1-2
Shotfirer fails to check the colour of	

7.38E-04

Shotfirer connects wrong surface

7.38E-04

connector

2.4.2 Shotfirer/Blasting Competent Supervisor fails to detect and respond to error

3.69E-02	5.54E-03	3.69E-02	5.54E-03
Shotfirer fails to detect error	Shotfirer fails to correct error	to detect error	to correct error
		Blasting Competent Supervisor fails	Blasting Competent Supervisor fails
2.4.2-1	2.4.2-2	2.4.2-3	2.4.2-4
OR		OR	
4.24E-02		4.24E-02	
error		to detect and correct error	
Shortfirer fails to detect and correct		Blasting Competent Supervisor fails	
2.4.2-SF		2.4.2-BCS	
AND			
1.80E-03			
respond to error			
Supervisor fails to detect and			
Shotfirer/Blasting Competent			
2.4.2			

2.4.3 Failure to detect and respond during final hook-up check

2.4.3					
Failure to detect and respond during					
final hook-up check					
3.01E-04					
AND					
2.4.3-BE		2.4.3-RSS		2.4.3-SF	
Blasting Engineer fails to detect and		Resident Site Staff fails to detect and		Shotfirer fails to detect and correct	
correct error		correct error		error	
4.36E-02		1.62E-01		4.24E-02	
OR		OR		OR	
2.4.3-1	2.4.3-2	2.4.3-3	2.4.3-4	2.4.3-5	2.4.3-6
	Blasting Engineer fails to correct	Resident Site Staff fails to detect	Resident Site Staff fails to correct		
Blasting Engineer fails to detect error	error	error	error	Shotfirer fails to detect error	Shotfirer fails to correct error
3.79E-02	5.69E-03	1.57E-01	5.24E-03	3.69E-02	5.54E-03

2.4-W-SC

8.86E-03

Use of a wrong surface connector

2.4-W-SC		
Use of a wrong surface connector		
4.80E-09		
AND		
2.4.1	2.4.2	2.4.3
	Shotfirer/Blasting Competent	
Incorrect installation of surface	Supervisor Fails to Detect and	Failure to Detect and Respond during
connector	Respond to Error	Final Hook-up Check

1.80E-03

3.01E-04

4.1.1 Excess cartridged are loaded into holes

4.1.1	
Excess cartridges are loaded into	
holes	

7.38E-04

4.1.1-1

Shotfirer does not count number of cartridges picked up and loads too many

7.38E-04

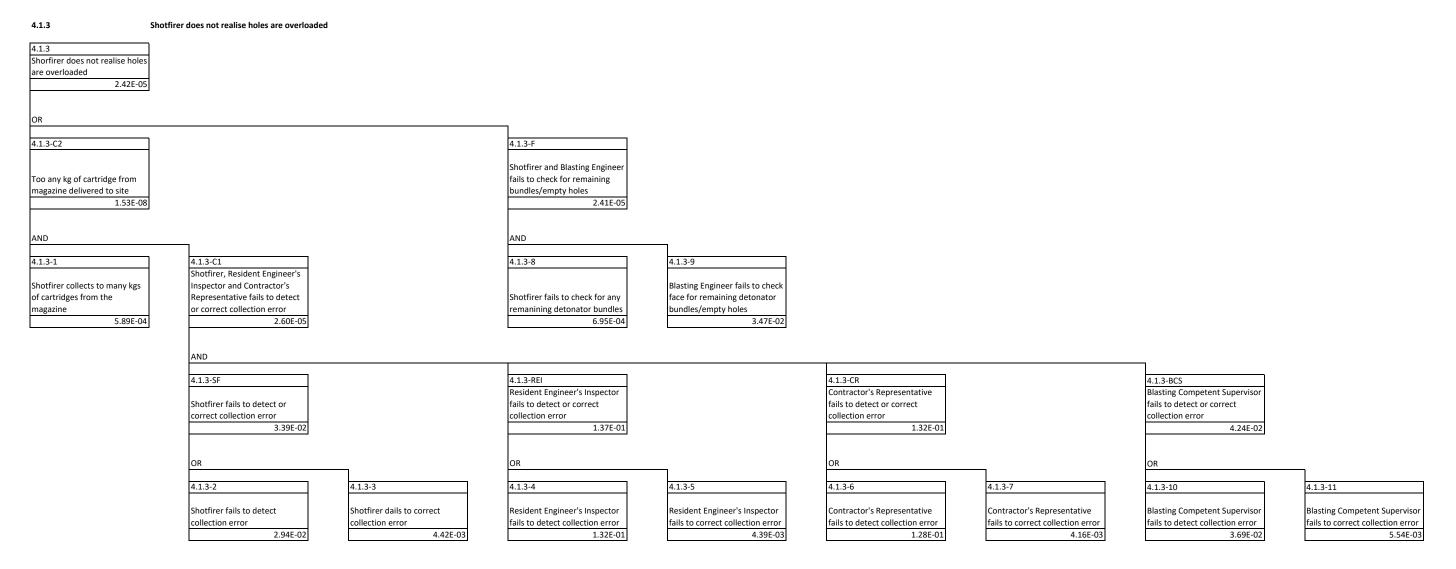
4.1.2 Cartridges from blocked holes are not disposed of correctly

4.1.2
Cartridges from blocked holes are
not disposed of correctly
8.13E-0

4.1.2-1
Shotfirer intentionally overloads lifter

holes

8 13F-



4.2.1 Design Error by the Blasting Engineer

4.2.1		
Design Error by the Blasting Engineer 8.52E-05		
AND		
4.2.1-1	4.2.1-BE	
Design error by Blasting Engineer	Blasting Engineer fails to detect and correct error	
6.05E-04	1.41E-01	
	OR	
	4.2.1-2	4.2.1-3 Blasting Engineer fails to correct
	Blasting Engineer fails to detect error	error
	1.36E-01	4.54E-0

4.2.2 Failure to detect and correct design error

4.2.2			
Failure to detect and correct design			
error			
1.06E-03			
AND			
4.2.2-RE		4.2.2-MD	
Resident Engineer fails to detect and		Mines Division fails to detect and	
correct error		correct error	
3.35E-02		3.17E-02	
OR		OR	
4.2.2-1	4.2.2-2	4.2.2-3	4.2.2-4
Residnent Engineer fails to detect	Resident Engineer fails to correct		
error	error	Mines Division fails to detect error	Mines Division fails to correct error
2.92E-02	4.37E-03	2.76E-02	4.14E-03

1.1.1

Design Error by Blasting Engineer and Failure of Design Check

1.1.1		
Design Error by Blasting Engineer and		
Failure of Design Check		
1.05E-03		
AND		
1.1.1-1	1.1.1-C1	
Design error by Blasting Engineer and	Failure to detect or correct error by	
Failure of Design Check	Blasting Engineer	
3.03E-02	3.48E-02	
	OR	
	1.1.1-2	1.1.1-3
	Failure to detect and correct error by	Failure to correct error by Blasting
	Resident Engineer and Mines Division	Engineer during modelling
	3.03E-02	4.54E-03

1.1.2 Failure to detect and correct error by Resident Engineer and Mines Division

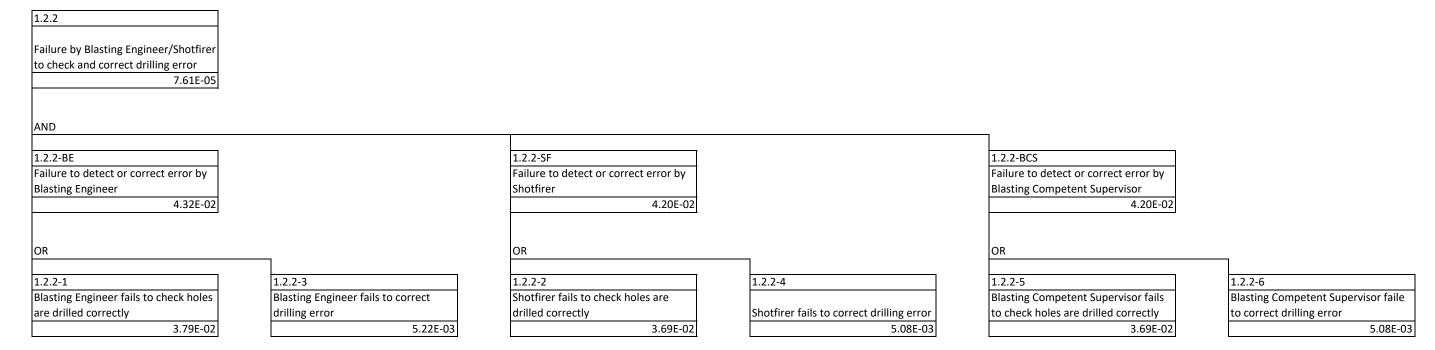
		Division	Failure to detect error by Shotfirer	
Failure to correct error by Resident	Failure to detect error by Mines	Failure to correct error by Mines		
1.1.2-3	1.1.2-2	1.1.2-4	1.1.2-5	1.1.2-6
	OR		OR	
	3.17E-02		3.35E-02	
	Mines Division		Shotfirer	
	Failure to detect and correct error by		Failure to detect and correct error by	
	1.1.2-MD		1.1.2-SF	
_		Failure to detect and correct error by Mines Division 3.17E-02 OR 1.1.2-3	Failure to detect and correct error by Mines Division 3.17E-02 OR 1.1.2-3 1.1.2-2 1.1.2-4	Failure to detect and correct error by Mines Division OR 1.1.2-3 Failure to detect and correct error by Shotfirer OR Tailure to detect and correct error by Shotfirer 1.1.2-2 1.1.2-4 Tailure to detect and correct error by Shotfirer OR 1.1.2-5

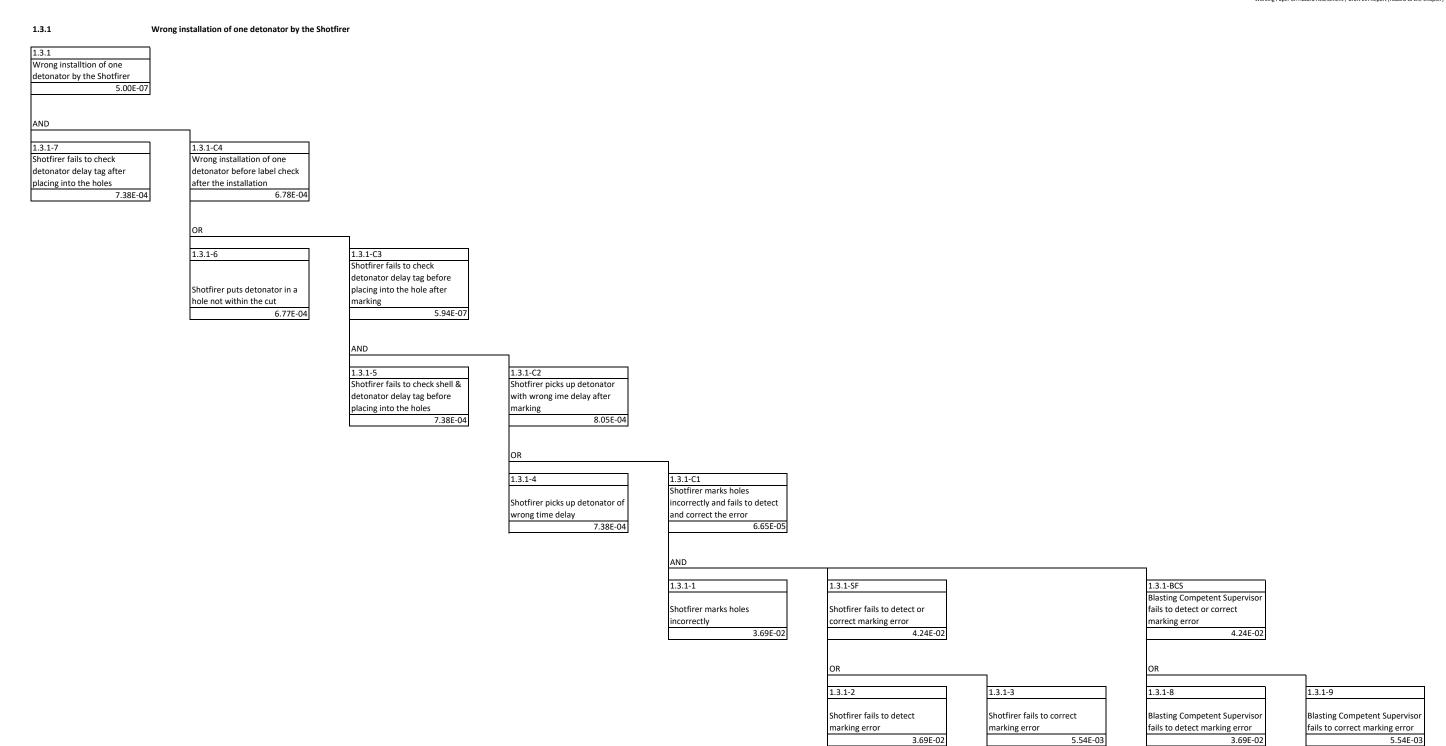
1.2.1

Failure by Blasting Engineer/Shotfirer to check and correct drilling error

1.2.1	
Operator fails to drill correctly	
2.26E-02	
OR	
1.2.1-1	1.2.1-2
Surveors calculate incorrect co-	
ordinates, leading to operator having	Blasting Engineer inputs wrong
disc with incorrect information	information on to disc
2.20E-02	6.05E-04

1.2.2 Failure by Blasting Engineer/Shotfirer to check and correct drilling error





1.3.2

Shotfirer fails to detect and correct that there are holes without detonators left in the face

1.3.2
Shotfirer fails to detect and correct
Shotfirer fails to detect and correct that there are holes without
detonators left in the face
4.24E-02

ΛP

1.3.2-1

Shotfirer leaves empty holes in the blast face due to not realising that are detonators left over

3.69E-02

1.3.2-2

Shotfirer fails to fill empty holes before detonation

5.54E-03

CH-WHD

Wrong hole diameter or location for relief holes at cut

CH-WHD					
Wrong hole diameter or location for					
relief holes at cut					
8.79E-07					
OR					
CH-WHD-C1			CH-WHD-C2		
			Wrong location of drilling or		
			incorrect frill size being used due to		
Wrong design in relief holes			human error		
1.88E-08			8.60E-07		
2,002 00			3.002 07		
AND			AND		
7.11.0			7.11.5		
1.1.1	1.1.2	P-FF	1.2.1	1.2.2	P-FF
Design error by Blasting Engineer and	Failure to detect and correct error by	Design error signidicant enough to		Failure by Blasting Engineer/Shotfirer	Design error signidicant enough to
Failure of design check	Resident Engineer and Mines Division	cause higher vibration	Operator fails to drill correctly	to check and correct drilling error	cause higher vibration
1.05E-03	3.56E-05	0.5	2.26E-02	7.61E-05	0

CH-WD-TD

Wrong design of time delay of more than 2 production holes in cut

CH-WD-TD Wrong design of time delay of more than 2 production holes in cut AND CH-WD-TD-C1 P-AD-DETON P-AD-DETON Wrong design of time delay of one Wrong design of time delay of one Wrong design of time delay of one additional production hole in cut production hole in cut additional production hole in cut 1.26E-09 0.01 0.01 AND 1.1.1 1.1.2 Failure to detect and correct error by Design error by Blasting Engineer and Resident Engineer, Mines Division Failure of design check and Shotfirers 1.05E-03 1.19E-06

CH-WI-TD

by the Shotfirer

3.00E-06

Wrong installation of more than two detonators in cut (longer time delay from other sector put into the cut)

CH-WI-TD Wrong installation of more than two detonators in cut (longer time delay from other sector put into the cut) 1.27E-11 AND CH-WI-TD-C1 P-AD-DETON P-AD-DETON Wrong installation of one detonator Wrong installation of additional one Wrong installation of additional one in cut (longer time delay from other detonator in cut (longer time delay detonator in cut (longer time delay sector put into the cut) from other sector put into the cut) from other sector put into the cut) 1.27E-07 0.01 0.01 AND 1.3.2 1.3.1 Shotfirer fails to detect and correct Wrong installtion of one detonator that there are holes without

4.24E-02

detonators left in the face

CH-TD-MD

Incorrect time default of more than two detonators due to manufacturer defect

CH-TD-MD
Incorrect time default of more than
two detonators due to manufacturer
defect

2.40E-09

AND

MD-DETON

Incorrect time default of one detonator due to manufacturer defect

2.40E-05

P-AD-DETON

Incorrect time default of one additional detonator due to manufacturer defect

0.01

P-AD-DETON

Incorrect time default of one additional detonator due to manufacturer defect

0.01

2.40E-09

СН Higher than expected vibration due to cut hole error Higher than expected vibration due to cut hole error 8.81E-07 CH-WHD CH-C1 Wrong hole diameter or location for relief holes at cut Wrong time delay at cut 8.79E-07 2.41E-09 OR CH-WD-TD CH-WI-TD CH-TD-MD Wrong installation of more than two Incorrect time default of more than Wrong design of time delay of more detonators in cut (longer time delay two detonators due to manufacturer defect than 2 production holes in cut from other sector put into the cut)

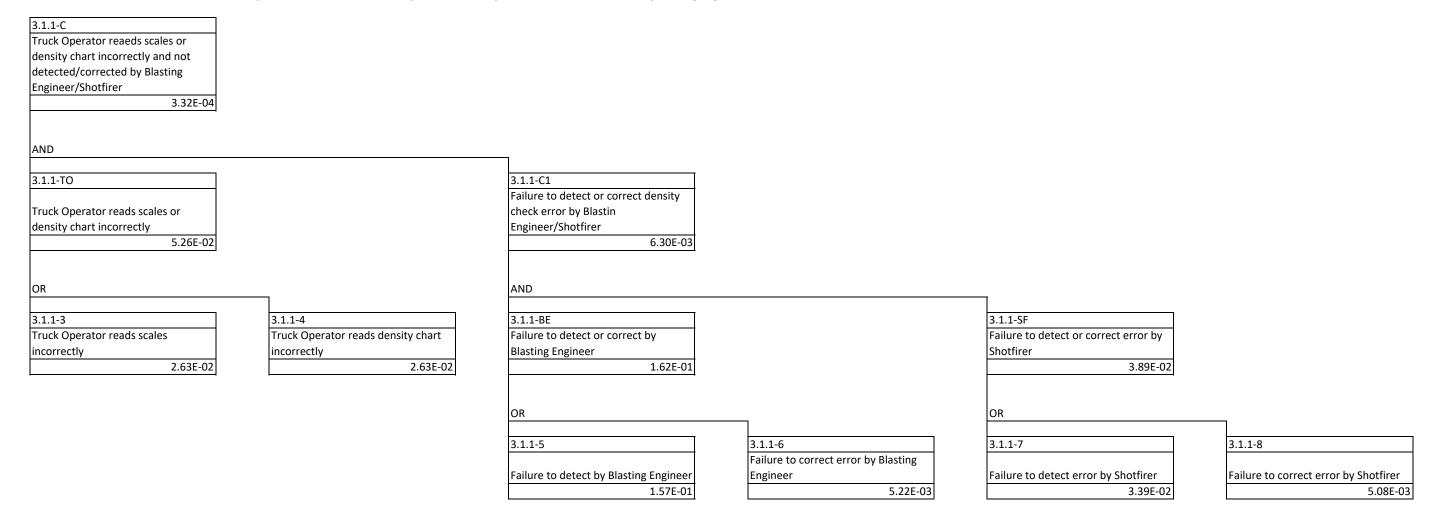
1.27E-11

1.26E-13

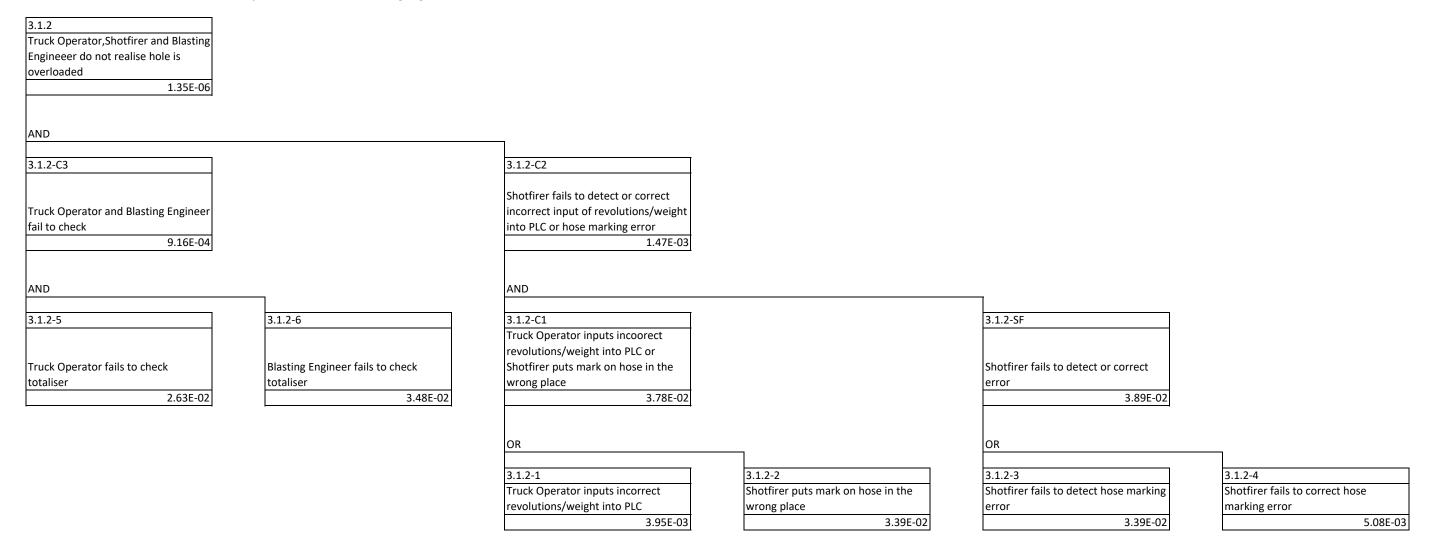
3.1.1 Excess emulsion is loaded due to wrong density

3.1.1 Excess emulsion is loaded due to					
wrong density					
1.11E-12					
AND					
		24464			
Truck Operator sets gassing flow		3.1.1-C4			
meter or read density chart		Truck Operator reads scales or			
incorrectly		dentity incorrectly 3.65E-11			
3.03E-02					
3,632.62		5.651 11			
OR		AND			
3.1.1-1	3.1.1-2	3.1.1-C	3.1.1-C	3.1.1-C	
5.1.1-1	3.1.1-2	5.1.1-0	Truck Operator reaeds scales or	Truck Operator reaeds scales or	
		Truck Operator reaeds scales or	density chart incorrectly and not	density chart incorrectly and not	
		density chart incorrectly and not	detected/corrected by Blasting	detected/corrected by Blasting	
Truck Operator sets gassing flow	Truck Operator reads density chart	detected/corrected by Blasting	Engineer/Shotfirer (in the middle of	Engineer/Shotfirer (towards end of	
meter incorredtly	incorrectly	Engineer/Shotfirer (prior to loading)	loading)	loading)	
3.95E-03	2.63E-02	3.32E-04	3.32E-04	3.32E-04	
3.33E-03	2.03E-02	3.32E-04	3.32E-04	3.32E-0 ²	

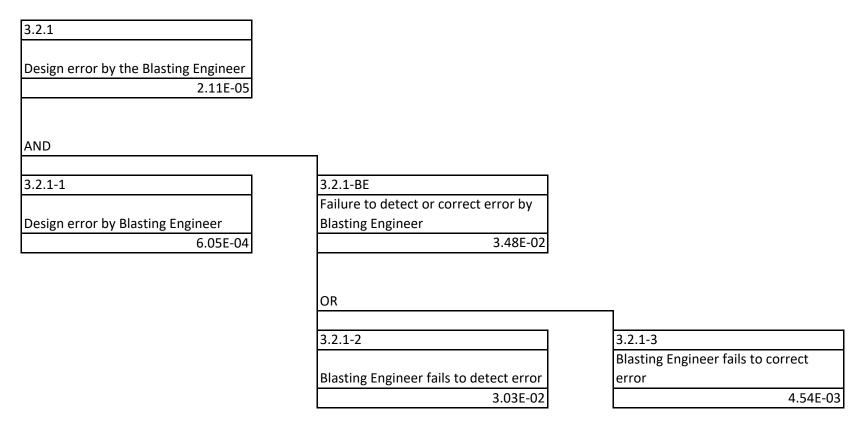
3.1.1-C Truck Operator reaeds scales or density chart incorrectly and not detected/corrected by Blasting Engineer/Shotfirer



3.1.2 Truck Operator, Shotfirer and Blasting Engineer do not realise hole is overloaded



3.2.1 Design error by the Blasting Engineer



3.2.2

Failure to detect and correct design error

2.92E-02	4.37E-03	5.52E-04	5.52E-04		
error	error	Mines Division fails to detect error	Mines Division fails to correct error		
Resident Engineer fails to detect	Resident Engineer fails to correct				
3.2.2-1	3.2.2-2	3.2.2-3	3.2.2-4		
OR		OR			
3.35E-02		1.10E-03			
Resident Engineer		Mines Division			
Failure to detect or correct error by		Failure to detect or correct error by			
3.2.2-RE		3.2.2-MD			
AND					
3.701-05					
error 3.70E-05					
Failure to detect and correct design					
3.2.2					

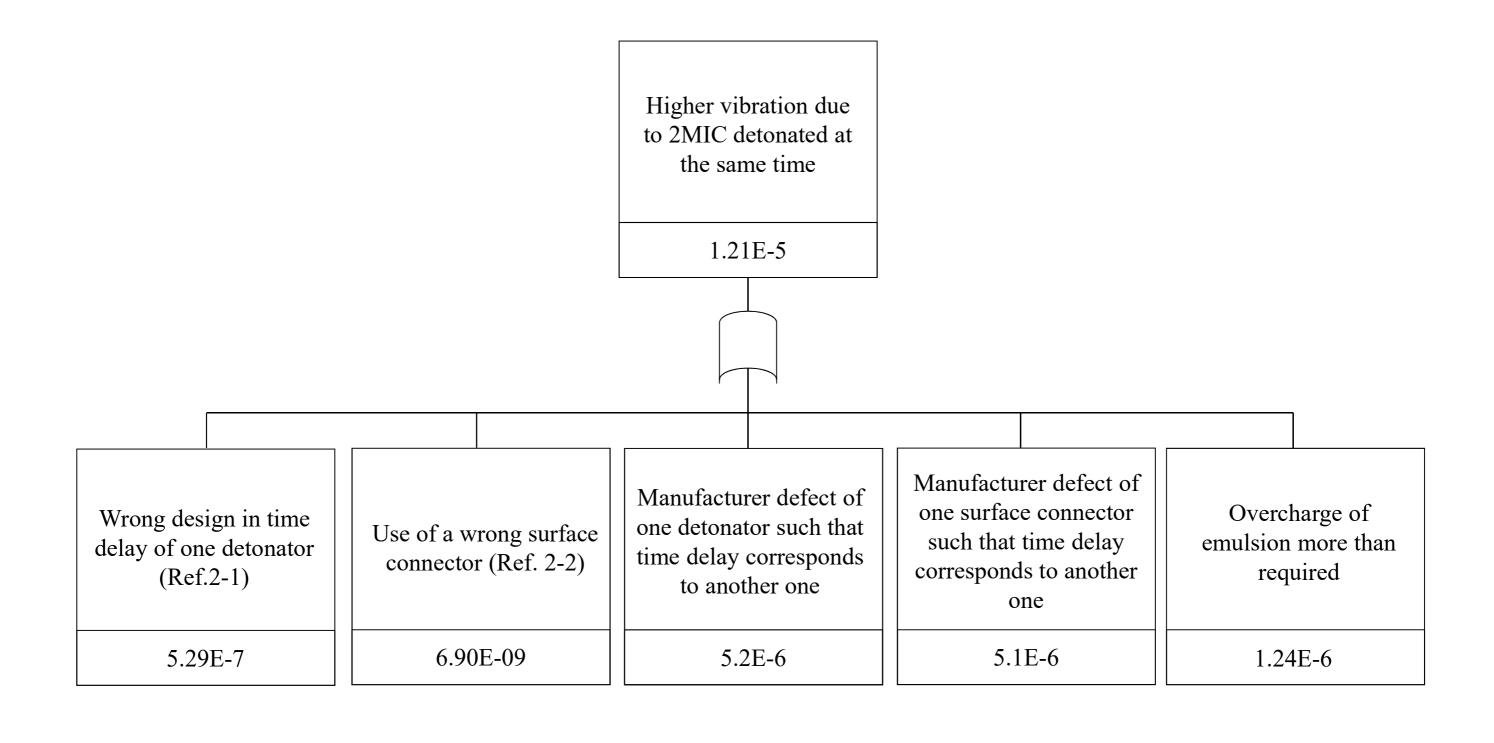
2.40E-04

2.40E-04

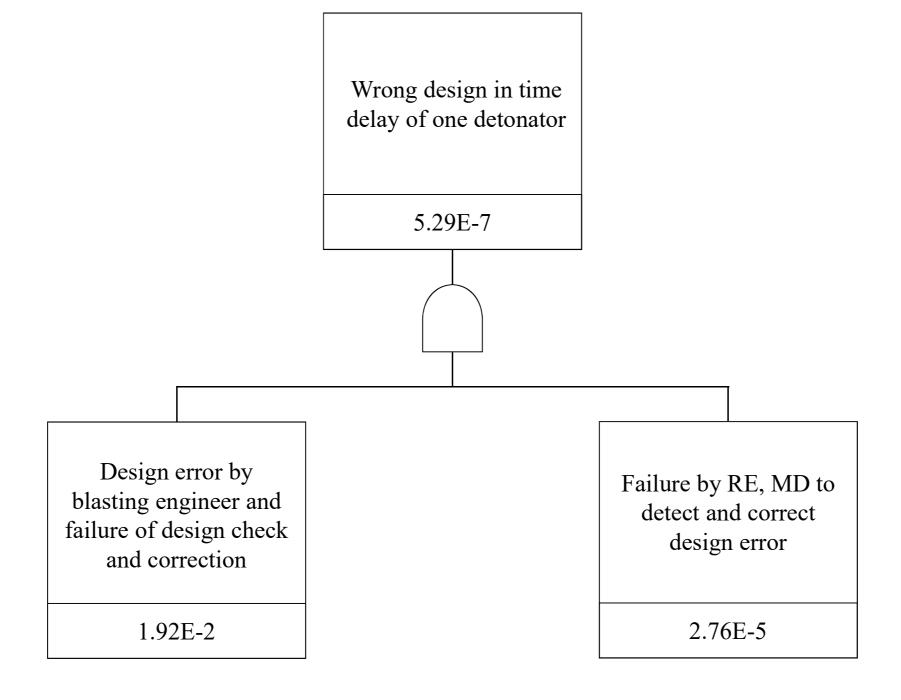
OL-B Too much bulk emulsion loaded into hole OL-B Too much bulk emulsion loaded into hole 1.41E-06 OL-B-C2 OL-B-C3 Too much bulk emulsion are loaded in holes and not realised Wrong design in MIC 7.80E-10 1.41E-06 AND 3.2.1 3.2.2 3.1.2 OL-B-C1 Truck Operator, Shotfirer and Design error by the Blasting Failure to detect and correct Blasting Engineer do not realise hole is overloaded Engineer design error Incorrect density check 3.70E-05 2.11E-05 1.35E-06 5.76E-08 3.1.1 P-MF-2 Excess emulsion is loaded due Wrong density check due to to wrong density mechanical failure 1.11E-12 5.76E-08 AND P-MF P-MF Gassing flow meter Scale out of calibration/malfunction malfunction

Annex 2

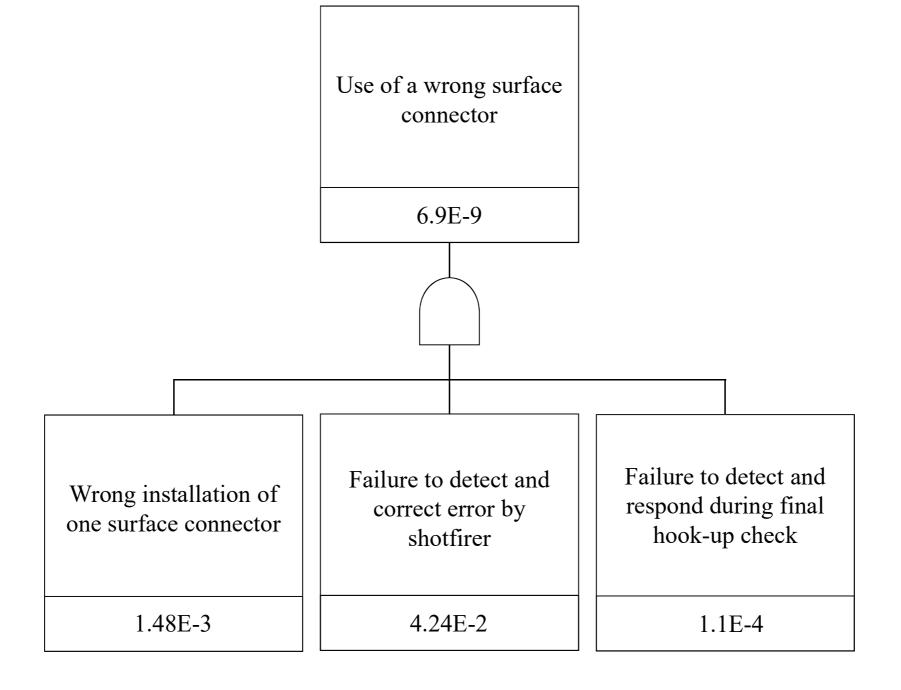
Fault Trees for Surface
Blasting

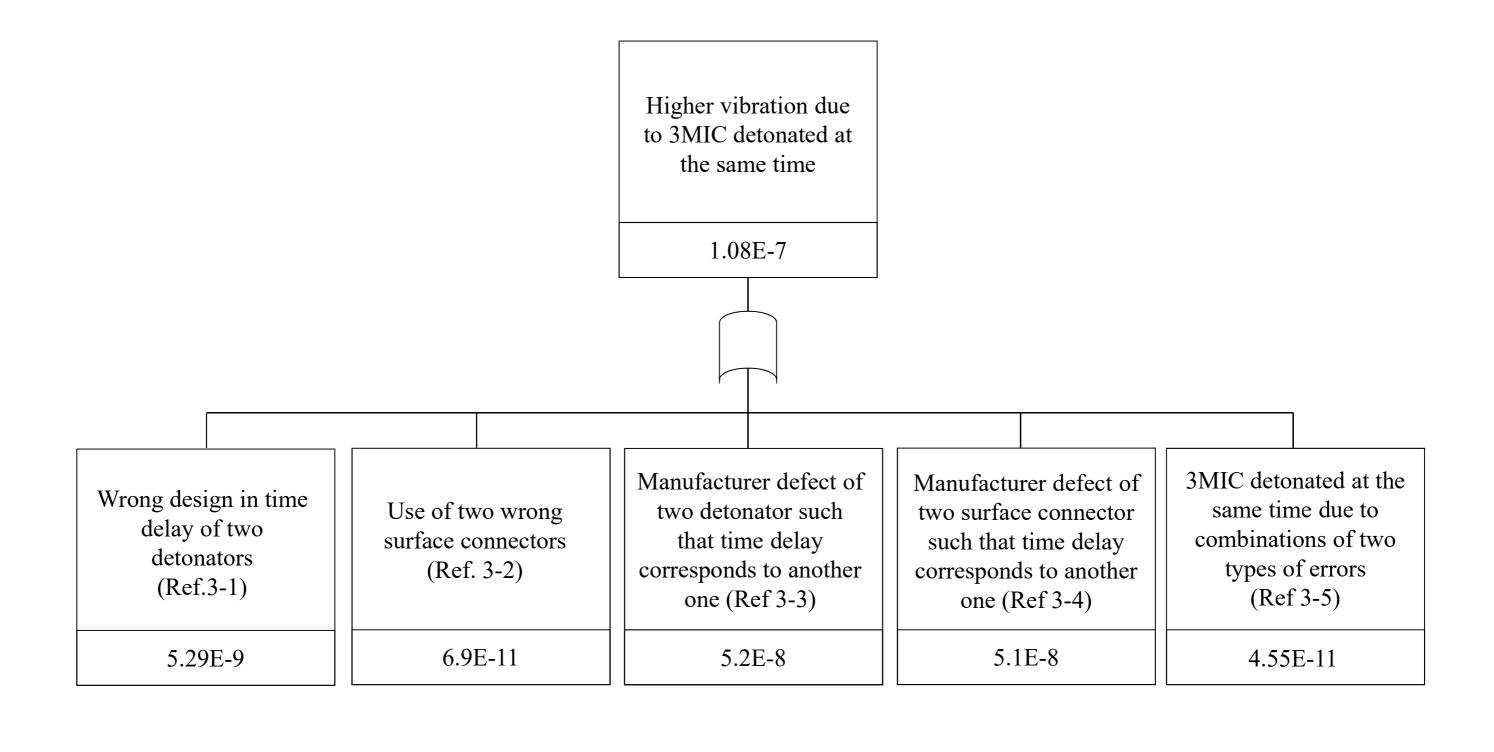


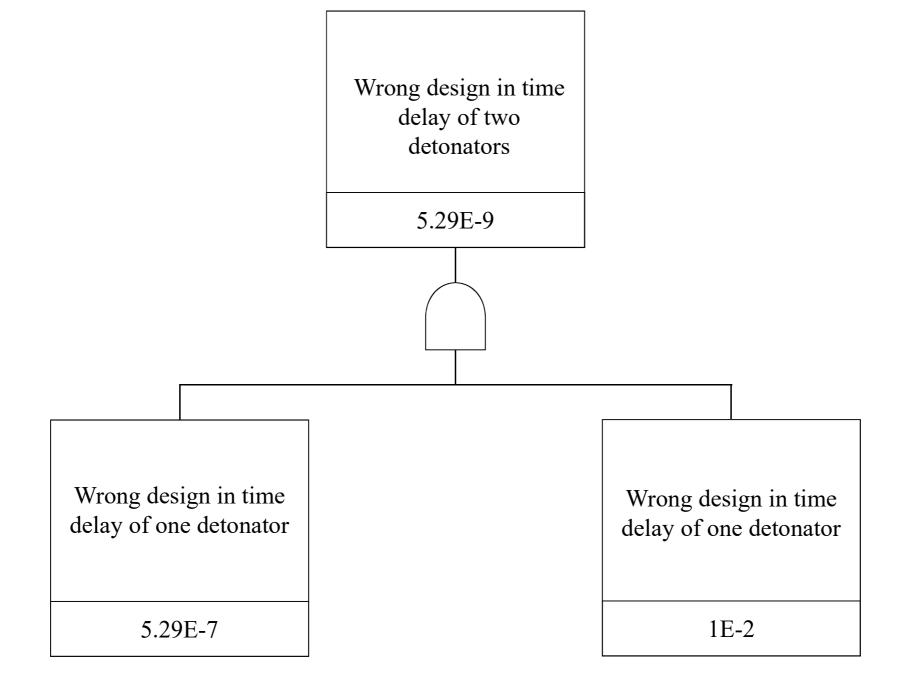
Ref. 2-1

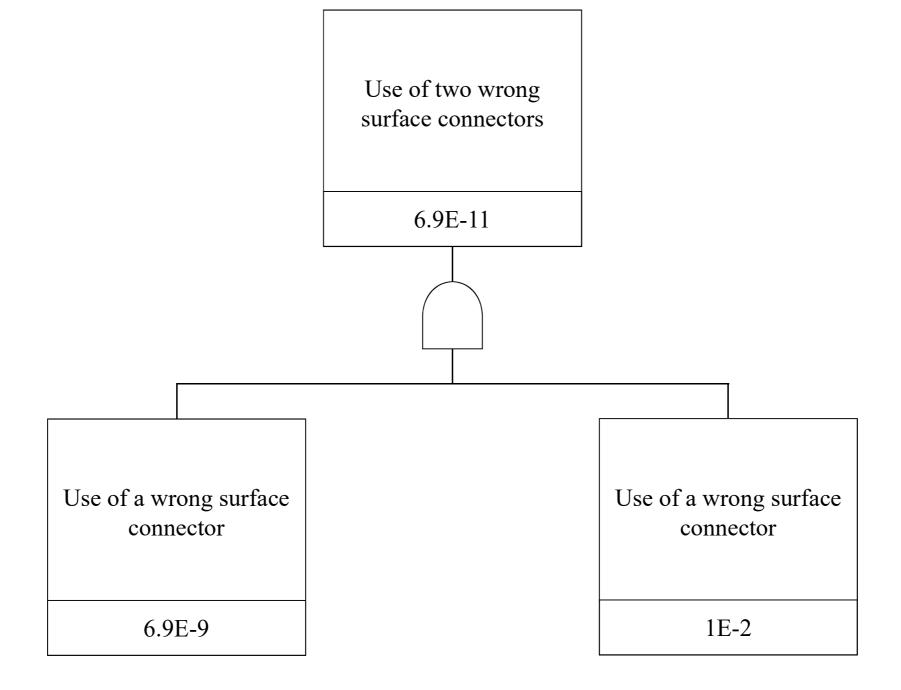


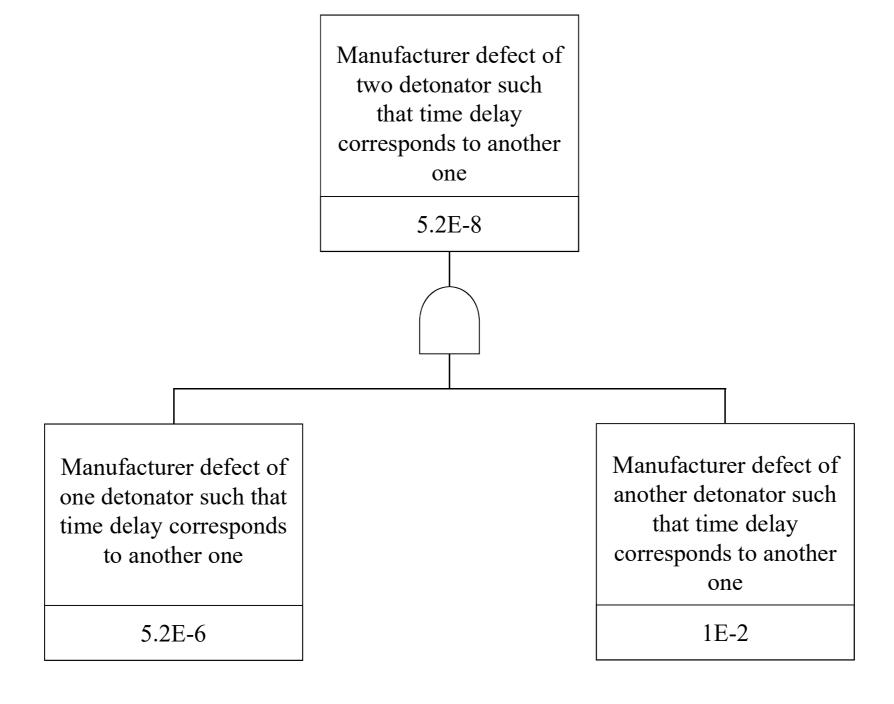
Ref. 2-2

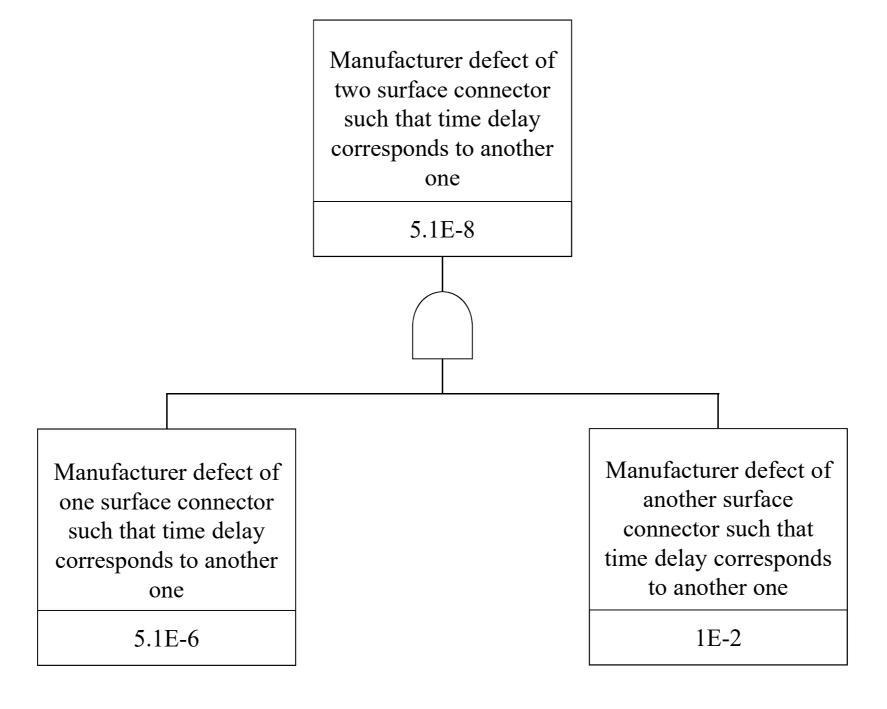


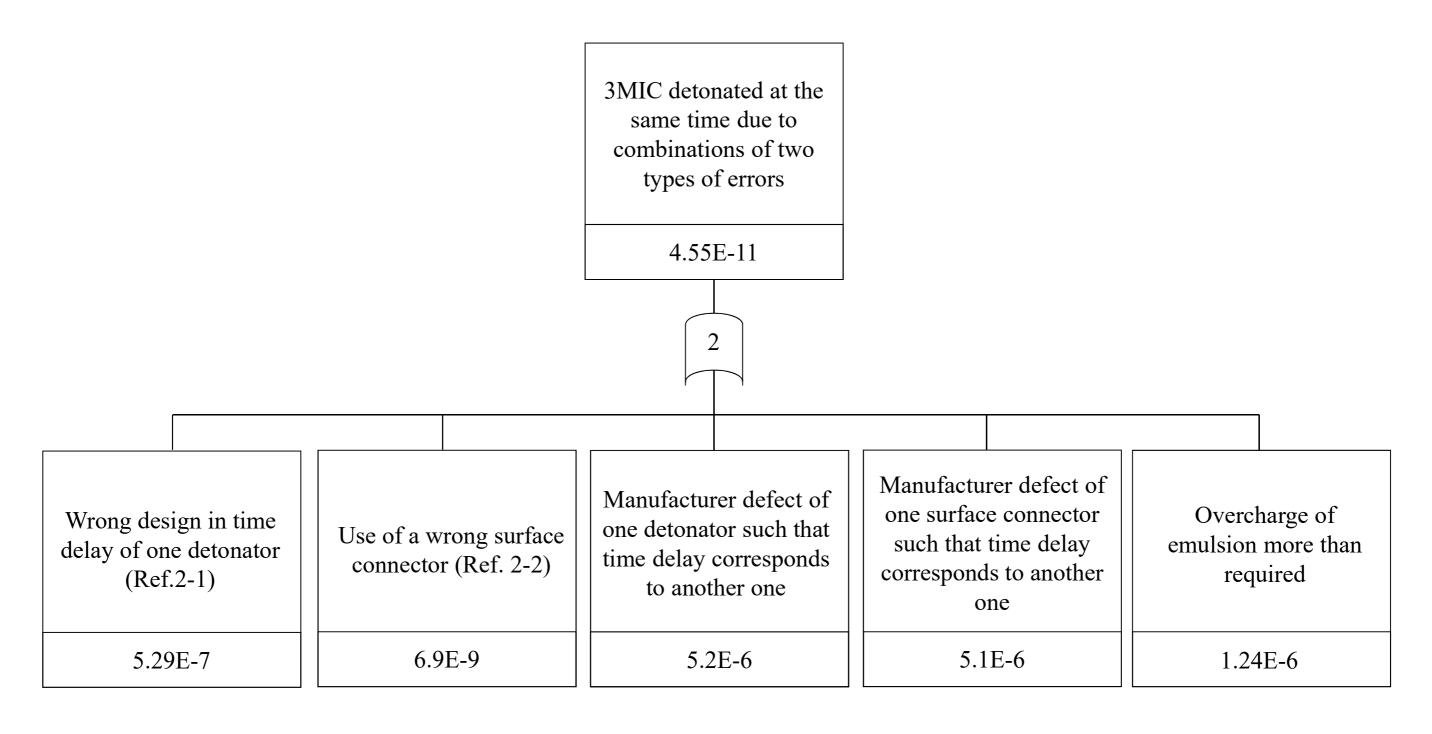


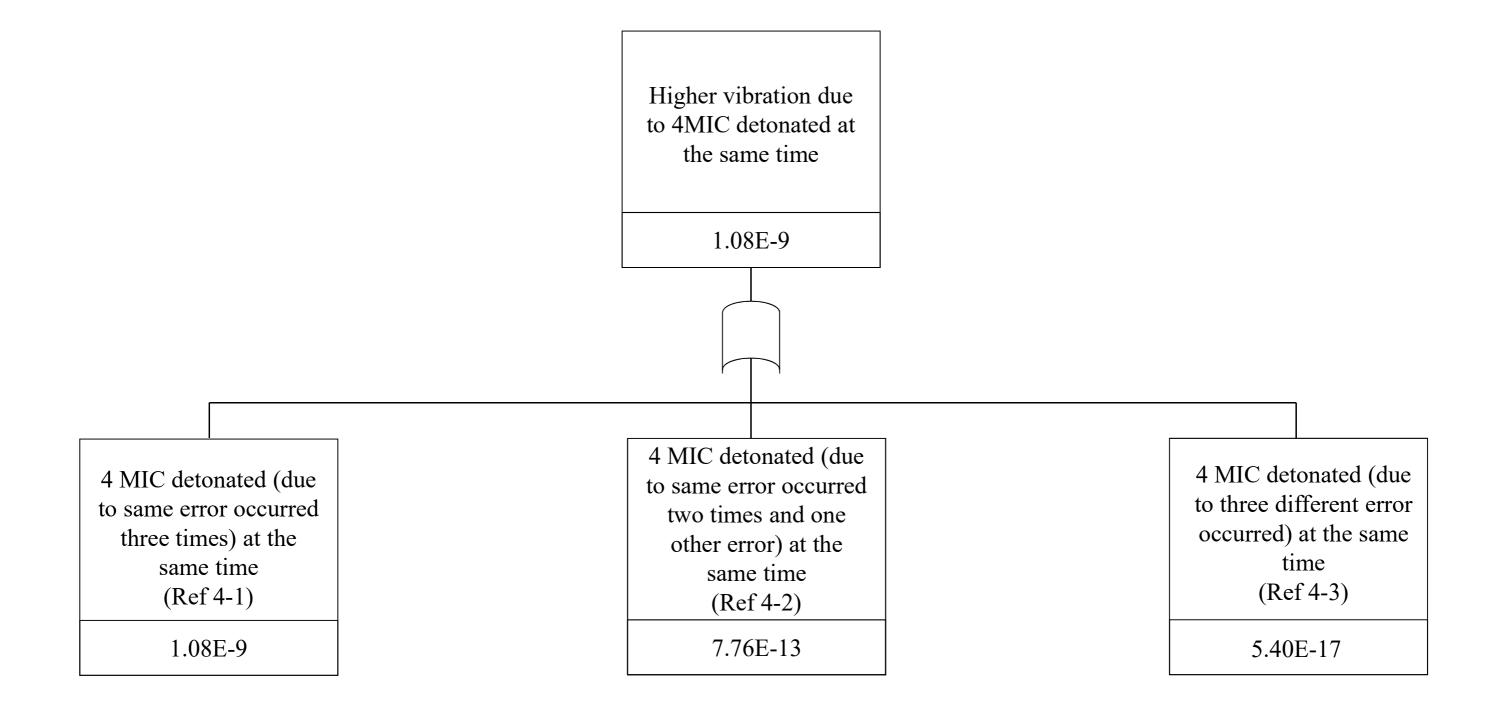




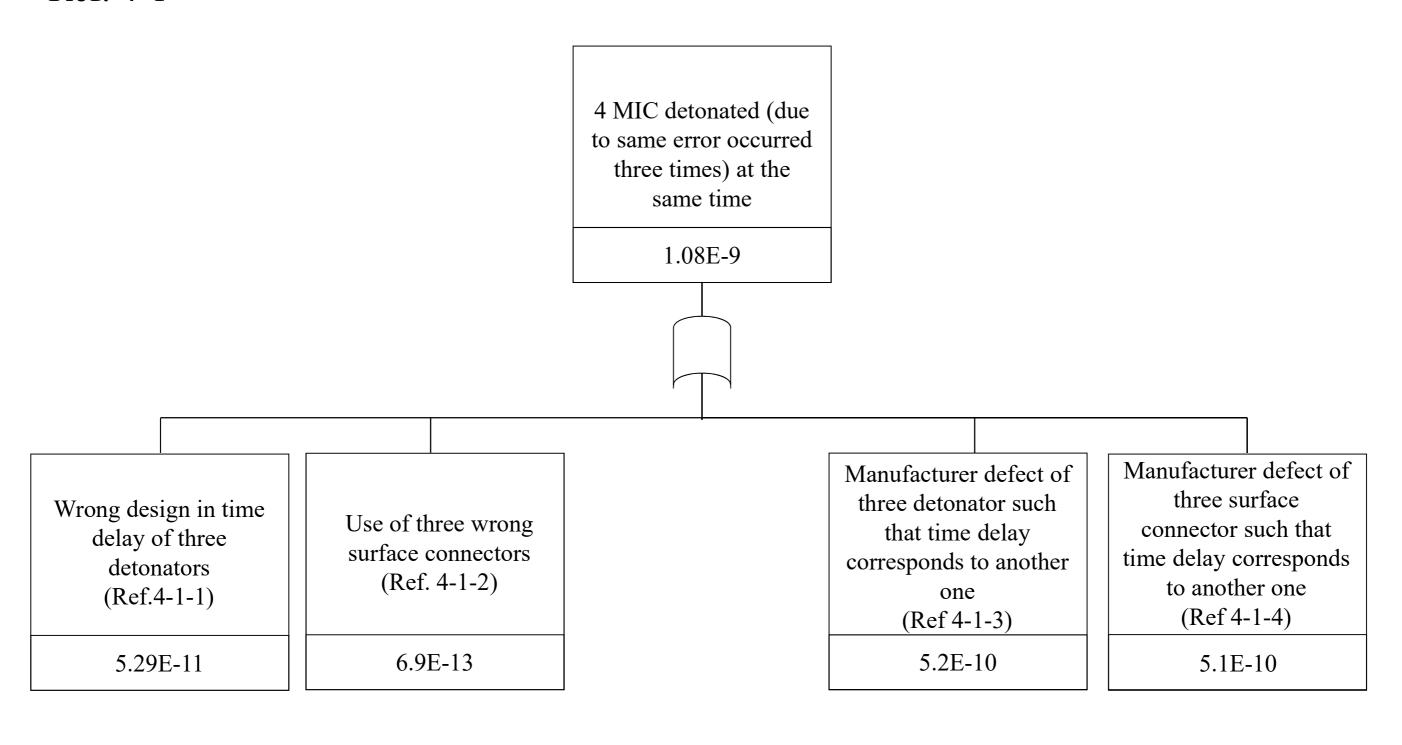


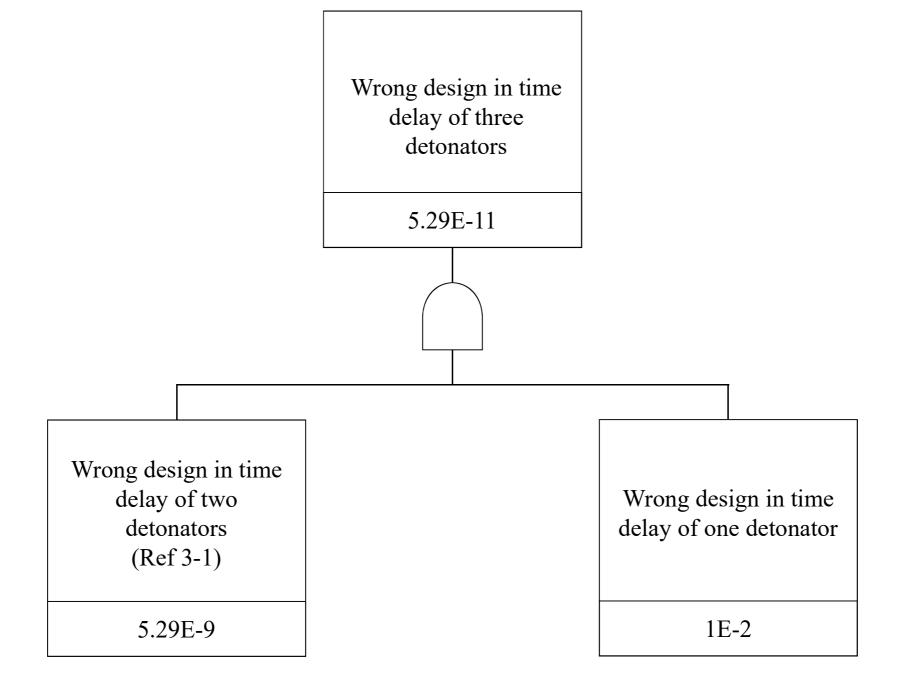


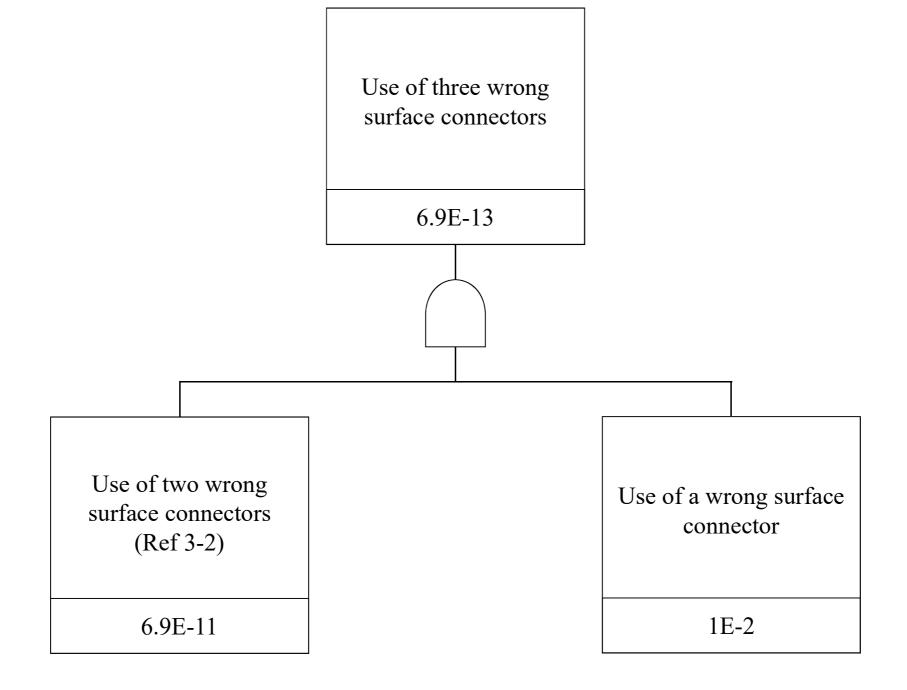


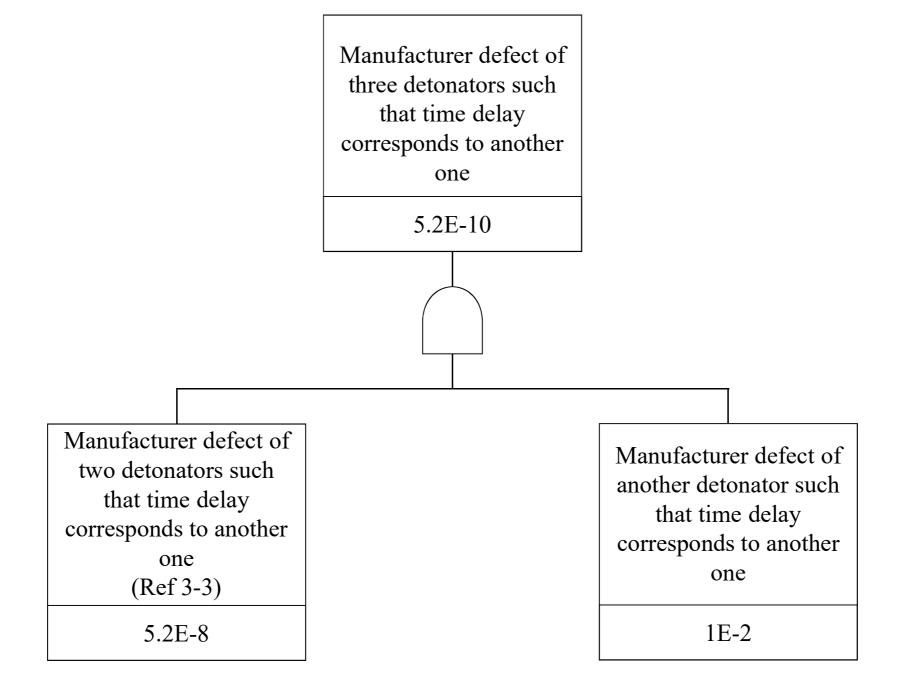


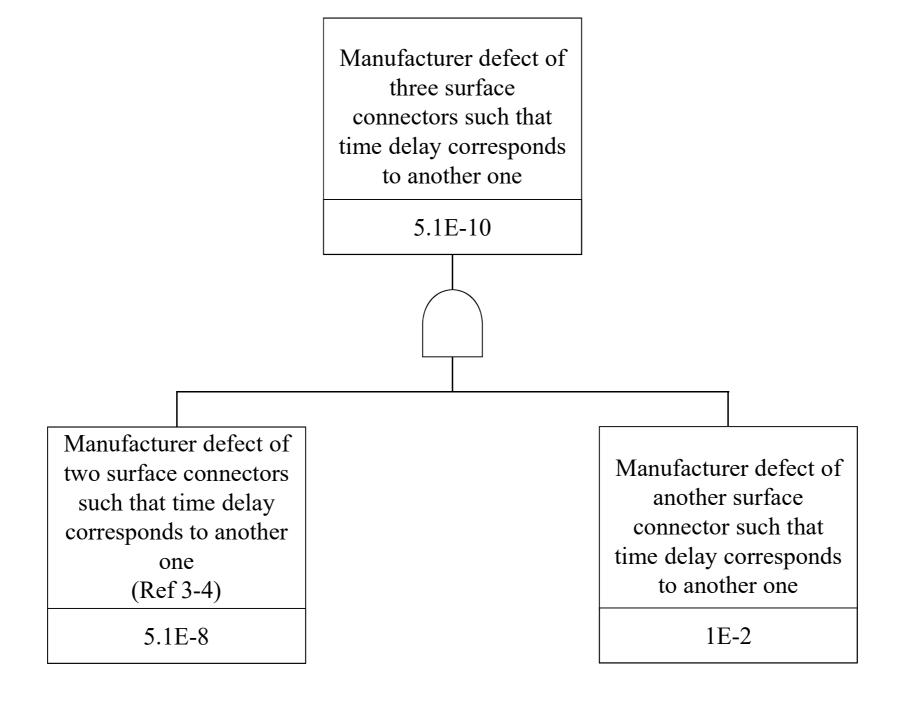
Ref. 4-1



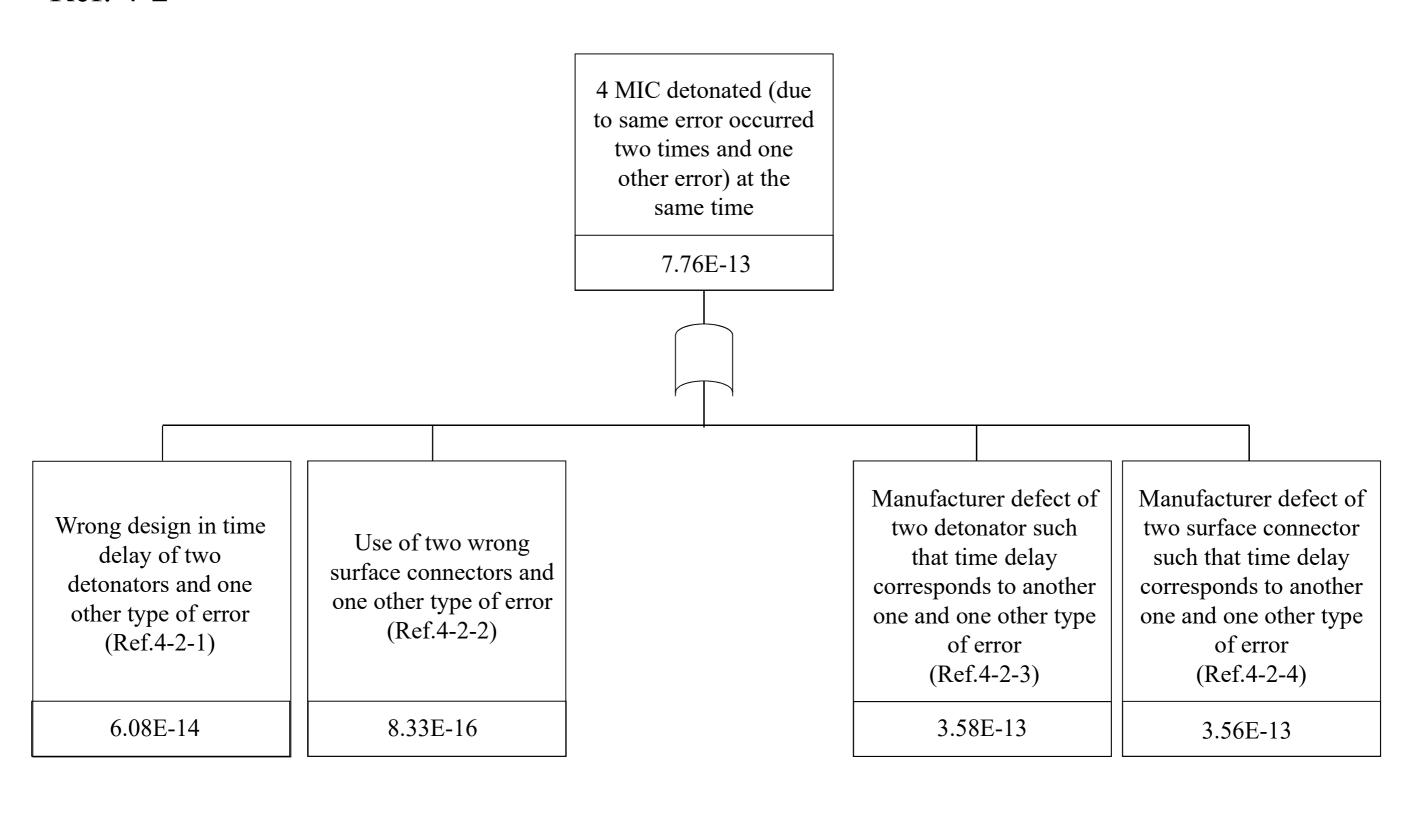


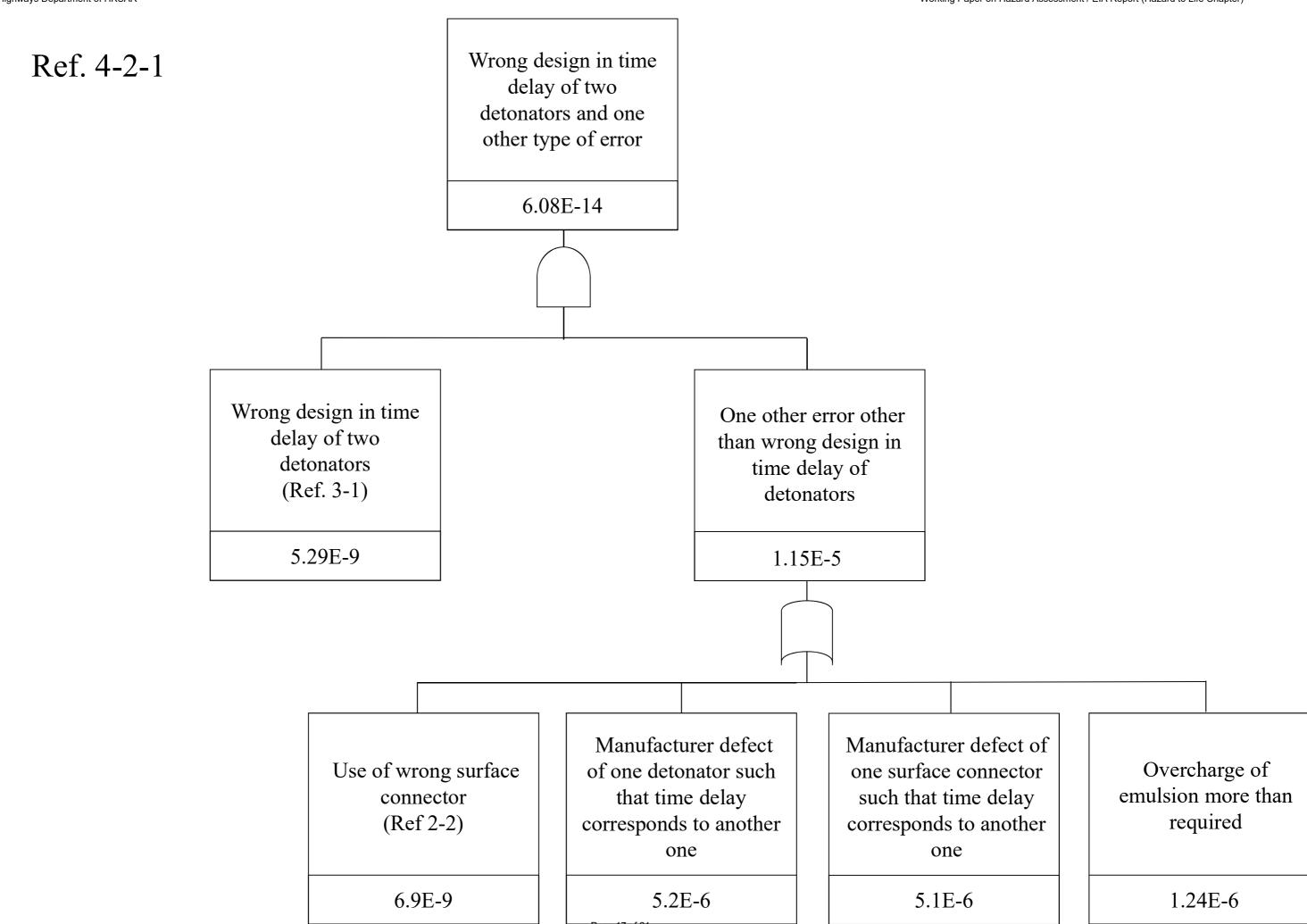


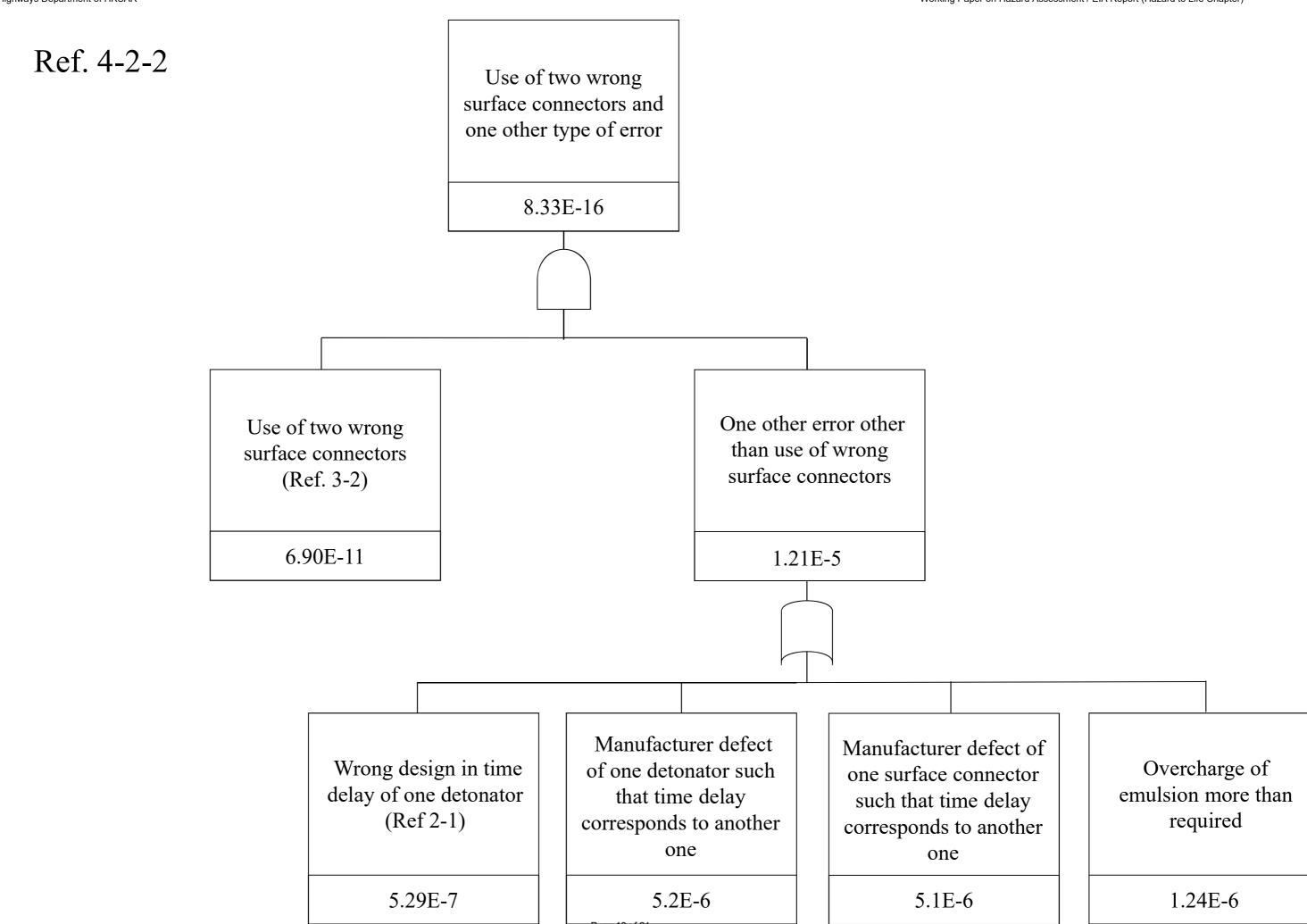


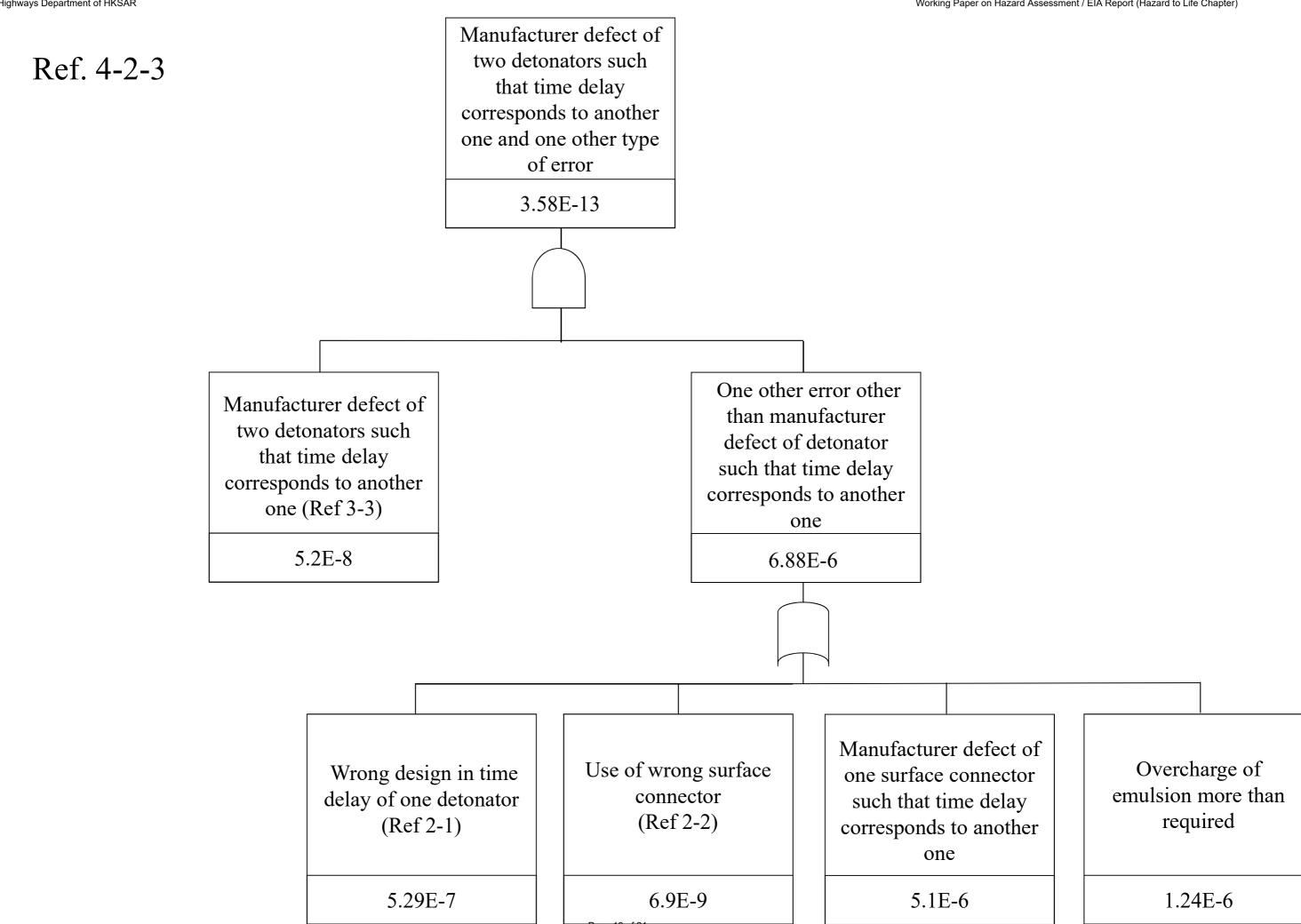


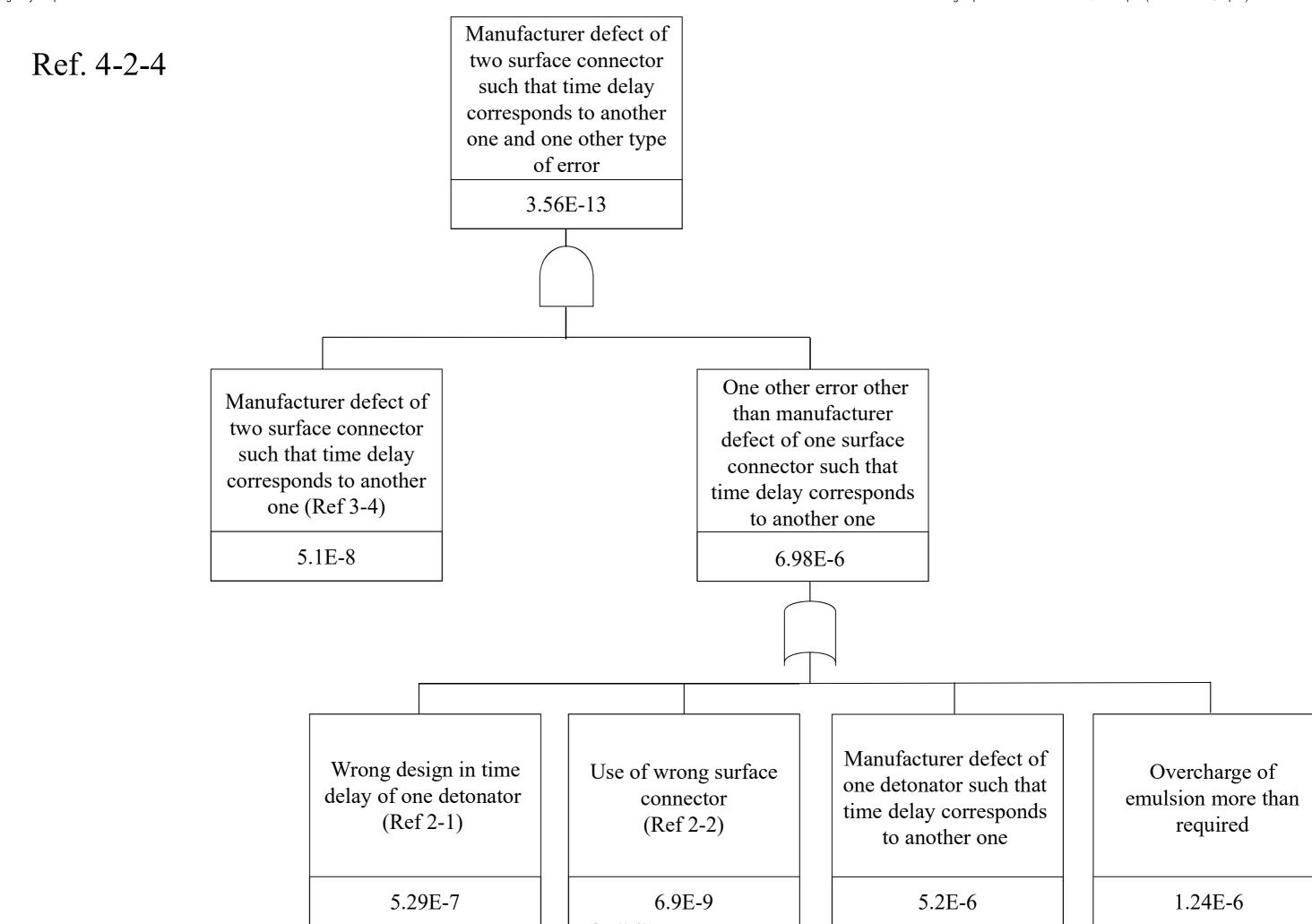
Ref. 4-2











Ref. 4-3

