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# Dynamic Rock Solutions LLC

**Drilling and Blasting Company Safety Policy**

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**POLICY STATEMENT**

Dynamic Rock Solutions is committed to providing a safe workplace for its employees and all others at or near our work sites. Our goal is to conduct blasting operations in the safest manner possible to minimize the risk of injury and property damage. This book defines the company's policy regarding all work in which explosives are stored, transported, and used. This safety policy will be communicated to our employees and contractors through on-site training and regular safety meetings. These policies do not supersede any federal, state or local regulations regarding explosives and blasting work. Compliance with these policies and all applicable federal, state, and local regulations will be strictly enforced.

**INTRODUCTION**

All contractors, employees, engineers, suppliers, regulators and all others involved in blasting operations are responsible for ensuring that work is done safely. Explosive users are also responsible for ensuring that explosive materials are securely stored and supervised. Horrible and preventable incidents involving children and explosives have occurred over the years. History proves that explosives accident and incident rates are significantly reduced when companies; 1) are rigorously committed to safety policies that apply well researched operating standards; and 2) conduct ongoing employee safety and operating procedures training. Many good sources of blasting safety information are available to explosive users. The IME (Institute of Explosives Makers) publishes safety booklets covering many blasting related safety issues. The ISEE (International Society of Explosives Engineers) has developed a modular blaster-training program using both videotapes and booklets. Explosive manufacturers, industry consultants and government agencies also provide many good explosive safety and application references.

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## 1. BLASTER IN CHARGE

History has proven that it is imperative to have blasting work performed under the supervision and total control of a single individual. This person, the so-called Blaster-In-Charge (BIC) should have complete authority over all activities that influence explosives and blasting safety. In many States, the licensed blaster is legally responsible for these

activities. Since the blaster is expected to assume responsibility for blasting, it is only fair that they also be given whatever authority is necessary to ensure that blasting is indeed performed safely. While blasting work is performed, the BIC should have control over all personnel and activities influencing the work. The blaster-in-charge should hold all required blasting licenses, have appropriate experience and training, and generally be responsible for the following:

A. Maintaining an explosives storage and transportation system that is safe and in compliance with all applicable regulations.

B. Implementing the specific blast plans that have been approved for the project.

C. Overseeing that all drilling and blasting work is done in a safe and efficient manner.

D. Inspecting field equipment to ensure its safety readiness.

E. Blast clearing and guarding operations.

F. Continuously monitoring the work habits of the blasting crew, and providing corrective actions when necessary.

G. Ensuring that all appropriate blasting plans, reports and explosive storage records are kept and submitted as required by both the project owner and regulatory agencies.

## 2. HAZARD AND RISK ASSESSMENT

The general and site-specific blasting hazards and environmental impacts should be defined for each blasting site. Blasting plans and procedures should incorporate all reasonable measures necessary to eliminate negative impacts on persons and minimize negative impacts on property and the environment. The following general hazard areas should be reviewed to help identify potential site-specific hazards and controls for each blast site.

A. Define public and commercial access, as well as traffic volumes.

B. Plot the location and condition of nearby structures.

C. Determine vibration and airblast limits (or peak-water-pressure limits—if blast is under water).

D. Determine public and regulatory notification requirements.

E. Know the location and condition of all nearby utilities either above or below the ground or water surface.

F. Define who is responsible for any damage, or claims of damage, to any nearby property.

G. Study the area's blasting history with respect to incidents, damage claims or litigation.

H. Determine environmental, topographical or geological conditions that might require special blasting control measures.

I. Define hazardous material notification requirements for employees, and develop an implementation program.

J. Stray current tests should be performed at blast sites before any electric detonators are used.

K. If extraneous electricity causes current flow exceeding 0.05 amperes at a blast site,

## 3. EXPLOSIVE STORAGE

If temporary explosive storage magazines are used on or near the site, the blaster-in-charge should ensure complete compliance with federal, state, and local regulations governing explosive storage.

A. The blaster-in-charge should thoroughly review and understand all of the Federal Bureau of Alcohol, Tobacco, and Firearms (BATF) regulations with regard to:

1. Magazine construction requirements
2. Locking and storage requirements
3. Inventory record keeping requirements
4. Explosive loss reporting requirements
5. Table of distance requirements

B. Required magazine permits should be obtained as required by local and/or state authorities.

C. Emergency action plans should be submitted to the appropriate emergency response agency.

D. All explosives should be stored in cool, dry, well-ventilated magazines.

E. Magazines must be located in compliance with separation requirements in the ATF-Table of distance.

F. Combustible materials shall be kept at least 50 feet away from magazines, and dry grass or brush will be kept at least 25 feet away from explosive storage areas.

## 4. ON-SITE EXPLOSIVE TRANSPORTATION

The blaster-in-charge should ensure that:

A. On the blast site, all vehicles hauling explosives should be properly loaded and properly placarded to meet federal, state, DOT, and MSHA or OSHA requirements.

B. All vehicles should have appropriate safety equipment, such as fire extinguishers, as required by federal and state regulations.

C. Passengers should never accompany explosives.

D. Equipment or other materials should never share the same cargo space with explosives.

E. Explosive vehicles, safety equipment, and day boxes should be regularly inspected, maintained, cleaned, and meet all federal and state regulations.

F. All explosives, even trace quantities, should be removed from transportation equipment before it is serviced.

G. Day storage boxes should be properly built and marked as required by MSHA or OSHA regulations.

H. When detonators and explosives are transported in a day box, a four-inch hardwood or equivalent partition should separate them.

I. All necessary vehicles pertaining to the blast site will be the only vehicles allowed on the blast site.

J. Proper shipping papers should accompany explosives when they are delivered to and from the job site.

K. Explosive transportation should be monitored and supervised by a person who is both familiar with the inherent hazards and knowledgeable about procedures in case of fire or other abnormal occurrence.

## 5. BLAST DESIGN

In many blast applications, it is often impossible to fully satisfy all of the design objectives. Usually, some sort of trade-off analysis is needed to balance the design sacrifices based on priority. In blast design work, there are two general types of requirements, 1)-safety goals and 2) operational goals. Blast designs and loading procedures should always put safety concerns ahead of other operational goals. For instance, producing minus 12-inch rock might be an operational objective while controlling flyrock is a safety goal. Since the safety goals should have the highest priority, the blast plan might specify the use of conservative amount of stemming to control rock movement, thus sacrificing rock fragmentation in the top part of the blast. The following guidelines should be used to evaluate all blast design choices.

General Blast Design Considerations:

A. Blast designs should never compromise safety. Safety goals should have the highest design priority.

B. While satisfying all primary design objectives, blast designs should be as simple as possible.

C. The blast designer(s) should have thorough knowledge and understanding of the blast requirements and constraints for each individual application. If the lead blaster is unfamiliar with a particular application, design, or product, help should be obtained from your blasting supervisor.

D. Blast design geometry should be appropriate for the application. The geology of the blast site and area control requirements should be considered when selecting hole size, explosive diameter, stemming height, and all other design dimensions.

E. Initiation systems should provide adequate protection against stray current hazards.

F. Delay timing schemes should be as simple as possible, while providing adequate burden relief and sufficiently advanced in-hole energization to prevent surface cut-off failures.

G. Before any product is used, the product data sheets provided by the manufacturer should be consulted for guidelines regarding product use and limitations.

H. Blast designs should be completed before any loading begins and the design work should include drawings or sketches that can be used to direct loading and hookup operations.

I. In critical blasting situations, where there is any potential for damage or complaints due to blast-induced ground vibration, the blaster-in-charge should carefully determine the maximum charge per delay limit by using scaled distance formulas or some other accepted form of vibration control. The blaster should also ensure that the blast design satisfies these conditions.

J. The maximum limit vibration is 2.0 inches/sec at structures or wells.

K. At 100 feet blasts are approximately 115 dB, and at 1,000 feet away the dB noise is negligible.

## 6. BLAST PLANNING

Well thought out advance planning and preparation work should improve blasting productivity and safety. Blast planners should:

A. Determine the number of drillers, blasters and helpers necessary to perform the specified work; as well as their necessary skill/experience requisites.

B. Prepare a blasting work schedule with flexibility for unforeseen problems or delays.

C. Develop plans for dealing with special environmental conditions that might occur during this work. Examples are lightning, floods, cold or hot weather, etc.

D. Define and obtain any special equipment that may be needed for the blasting work. Equipment should include all tools and equipment needed for loading and blast execution, as well as blast area warning signs or barriers.

E. Plan to have back-up units to replace critical instruments like blasting machines and non-electric initiating devices.

F. The functionality of all critical instruments like blasting machines, testers, and seismographs should be tested the day before each scheduled blast.

G. Spare batteries and other essential parts for blasting instruments should be kept at the job site.

H. Evaluate local services and carefully screen potential product and service providers.

I. Investigate explosive storage and delivery options. If it is necessary to establish a temporary magazine site, allow several weeks to negotiate leases and permits.

## 7. DRILLING

A. All drillers should have appropriate experience and operating knowledge about each drill before they operate it.

B. Drillers should perform safety inspections on all drills before they are operated. Any conditions that might cause unsafe operation should be corrected before a drill is put into service.

C. Drills should be routinely serviced and lubricated as specified by the drill manufacture.

D. All safety equipment, like hose release guards, should be properly installed.

E. Drillers should monitor bit wear and penetration rates, and they should vary feed pressure, hammer rates and other operating variables to achieve maximum bit life.

F. The blaster-in-charge should establish a system for marking hole collar locations. Drillers should collar holes as close as possible to the designated collar location and they should carefully align the drill boom to guide the drill stem along the intended hole path.

G. The driller's primary goal is to drill properly aligned, clean holes. Drillers should vary hole-flushing rates and determine which drill settings are producing the cleanest and most accurately placed holes.

H. Holes should never be drilled in any positions where there is any chance that they might intersect a loaded blast hole. Unless a specific variance is granted, the minimum collar distance from a loaded hole should be greater than the planned depth of the new hole.

I. Drillers should keep logs that record any unusual conditions or adjustments to the original plan. Drill log information should be submitted to the blaster-in-charge at the end of each drilling shift.

## 8. BLAST LOADING

A. Use of the following personal protective equipment should be mandatory:

1. Protective head gear - hard hat
2. Protective footwear - leather work boots
3. Protective eye wear - approved safety glasses

B. The following protective equipment may be used and under certain conditions, supervisors may require their use.

1. Gloves
2. Ear Protection - plugs or muffs
3. Protective clothing
4. Personal flotation devices (for marine work)
5. Respirators

C. Safety Review Meetings:

The blaster-in-charge should assemble all blast crew personnel to conduct a safety review meeting before explosive loading work begins. The following issues should be addressed at each safety review meeting.

1. Identify the blaster-in-charge

2. Review personal safety responsibilities
3. Review site specific hazards
4. Review loading plans and procedures
5. Assign work responsibilities
6. Review equipment requirements and safe operation procedures
7. Review emergency and site security procedures
8. Review lightning detection and evacuation procedures
9. Review weather forecast
10. Review requirement that open flames or sparks should not occur on the blast site, and that smoking is absolutely prohibited.
11. Confirm that the crew has the proper tools to safely perform loading and site security tasks. Equipment not specifically approved for blasting work should not be used. Check the following (not all should apply for every job):
12. Non-sparking loading poles, powder punches, knives and cartridge retriever harpoons.
13. Blasting machines or non-electric starters
14. Testing equipment; blasters galvanometers/multimeters
15. Measuring tapes with non-sparking weights
16. Warning sirens
17. Lightning detector
18. Hole plugs
19. Radios, traffic cones, blasting area warning signs, traffic vests, fully stocked first aid kit and drinking water

D. Blast Site Inspection:

The blaster-in-charge and loading crew should inspect the blast site before loading begins. Hazards or conditions that might expose explosives to excessive pressure, heat or friction should be corrected prior to loading. If the inspection reveals that blasthole re-drilling is required, the re-drilling should be done before loading commences.

E. Stemming material and other materials that require automated transport should be placed near blastholes before loading begins. All effort should be made to keep automated equipment away from blast holes once loading begins.

F. The blast site should be clearly marked and all non-essential equipment and people should not be allowed on the blast site once hole loading operations begin, or be no less than 50 feet from a loaded hole.

G. Blast hole locations and depths should be measured before loading begins.

H. Primers should be prepared just before they are loaded.

I. Explosive column buildup should be continuously monitored to ensure that the charge has not separated and that the correct amount of explosives is loaded.

J. When column separation is suspected, a second primer using the same delay detonator as the first primer should be loaded into the separated portion of the column.

K. If damage to an initiator lead is suspected, the hole should be re-primed with a similar primer.

L. When it is necessary to operate mobile equipment on the blast site, the blaster-in-charge shall closely monitor every movement and setup. Extreme care should be taken to ensure that detonators, initiator leads, and explosives are not run over, snagged, or otherwise damaged

by mobile equipment. Non-essential vehicles should not be allowed on the blast site.

M. No sparking materials should be allowed to enter blast holes after they contain explosives.

N. When field conditions show increased potential for flyrock, the blaster-in-charge should increase stemming heights, or use whatever other measures, he/she deems necessary to control excessive rock movement.

O. Blast-crew members should immediately report any potentially dangerous conditions, such as overloaded holes, to the blaster-in-charge who should develop measures to safely control the condition.

P. Records detailing the quantities of explosives brought to the site and used each day should be accurately kept.

## 9. INITIATION SYSTEM HOOK-UP PROCEDURES

A. Blasting machines and non-electric starters should be stored away from the blast area while blasts are loaded and tied in.

B. Only persons designated by the blaster-in-charge should participate in blast hook-ups. All other persons should vacate the blast site.

C. Blast crews should only use connections and hook-ups that are approved by the product manufacturer.

D. Blast hook-up should not begin until all holes have been loaded and stemmed. The blast security zone must be clear of all vehicles and unnecessary people. Also, ensure that there are no hazards that may delay the blast.

E. The blaster-in-charge, and one other crewmember, should independently inspect and double-check all hook-ups.

F. To prevent hook-up mistakes caused by rushing to meet a blasting time limit; blasting work schedules should allow adequate time for careful blast hook-up work.

G. Blast hookups should be completed at least one half hour before blast time, or with enough time to allow careful inspection of all initiation system connections prior to detonation.

H. Shock tube detonators should never be pulled until they break. Snapping tubes can and have caused premature detonations.

I. Mechanized equipment should be kept away from detonator leads and tubes especially when they are trailing from live holes.

## 10. BLAST AREA CLEARING AND SECURITY PROCEDURES

A. Pre-blast Review Meeting:

Before blasting, the blaster-in-charge should assemble all blast crew personnel to review the blast area security plan and blast emergency plan. The "blast area" is the entire zone that might be affected by any potential flying material, airblast or fumes that could cause injury to persons or damage to property. The blaster-in-charge should

cover the following issues and responsibilities at each pre-blast meeting.

1. Acknowledge the shot is properly loaded, hooked up, secured and ready for detonation.

2. Review the blasting firing time schedule.

3. Review the direction of blast movement and define the blast area for security purposes.

4. The blaster-in-charge should specify who should fire the shot and define the safe shot initiation location.

5. Review the communication system that should be used between the blaster-in-charge and all blast area security personnel.

6. Specify what signals should be used to announce:
   a) Preblast Warnings
   b) Blast Time
   c) All Clear
   d) Blast Countdown Suspension

7. Outline general emergency plans to be used in case of an accident or other unplanned event.

8. Review procedures for handling misfires.

B. Clearing and Guarding Procedures:

1. The blaster-in-charge should coordinate blasts with all concerned parties, on an approved blasting schedule.

2. A safe area around the shot area should be determined and cleared. The blaster-in-charge should assign guards to secure all possible entryways to the blast area. Guards should be located at a safe distance from the blast, or a substantial flyrock shelter should be provided for them. Pickup trucks and other light vehicles are not suitable shelter. A substantial cover should be closed on top and on three sides. The open side should face away from the blast and it should be able to withstand the impact of a heavy rock thrown from the blast site.

3. The evacuation of the immediate area, of a shot that is to be fired, is also a standard practice in our blasting procedure. Blasting will typically occur at lunch or between shift changes. This allows for minimum exposure of personnel and equipment and this practice also minimizes interruptions to the production equipment.

4. The first priority in our shot initiation process is to evacuate any equipment and personnel that may be working adjacent to a specific shot to a safe distance.

5. Dynamic Rock Solutions supervisory personnel will also block any access to the shot area at this time and verify the blocking by radio to (BIC) and shooter. The (BIC) at various blocking sites can notify the blaster by radio if a breach has occurred and someone has wandered into the potential danger zone. The shooter will stop the process at this time until site security has been reestablished and the signal procedure will start over.

6. After evacuation and blocking of the area is completed, the shot warning siren is sounded. At five minutes before the shot, horn signals of five-second duration will be sounded for one minute. At one minute of shot initiation, short horn signals of five seconds duration will be sounded for fifteen seconds.

7. The shot will then be fired at the five-minute mark from the first siren. Also the previously described time intervals will also be announced over the radio by the blaster or (BIC) so that all supervisory personnel know exact status.

8. After post blast fumes have dissipated to safe levels, the blaster-in-charge should inspect the shot area.

   During the examination, the blaster should look for:

   a) Dangerous rock conditions.
   b) The presence of undetonated explosives and/or initiators.
   c) Abnormal blast conditions and any other hazards.

9. If misfires or other hazards are present, the blaster-in-charge should supervise the removal of the hazard by the most appropriate and safest means available.

10. When the area is clear of hazards to nearby traffic and other job site personnel, the blaster-in-charge should relieve all guards and give the all clear signal to allow normal traffic and work to resume in the area.

11. An approved lightning detector should be used to monitor the approach of electrical storms while explosive materials are on-site.

12. When a lightning hazard is detected, the above clearing and guarding procedures should be used to clear and secure the area until the hazard has passed.

13. After each blast, the blast site should be thoroughly inspected for misfires, unstable rock or ground, toxic fumes or any other dangerous conditions. All dangerous conditions should be corrected or otherwise made safe before any other work resumes near the blast site.

C. Notice and Impact of Blasting:

1. Residents within 2,500 feet of the blast will be notified twenty four hours prior to the blast. A schedule of blast dates will be provided in a timely manner so landowners could be notified in a timely manner.

2. If a landowner has substantially reduced water flow (50-75% less flow rate) or water quality issues that are sustained after blast based on the well survey a new well would be provided.

## 11. Misfire Procedures

When blasting misfires occur, or are suspected, their existence and extent should be carefully established under the direction of the blaster-in-charge. Under these circumstances, the blaster-in-charge should:

A. Ensure that **no one** enters the blast area and it remains secured, for at least 30 minutes.

B. Develop a plan involving minimum people to safely re-fire, wash out or recover un-shot explosives, before any other normal work resumes near the blast site.

C. Record the location of any potentially un-detonated explosives on the blast report.

D. Expand the blast security area if flyrock potential is increased if misfires are re-blasted.

## 12. BLAST EMERGENCY PLAN

The elements of specific blast-emergency-plans should vary according to the unique conditions existing at each job site. Emergency plans should:

A. Include a posted and current list of all emergency response telephone numbers including; ambulance, hospital, OSHA or MSHA district office, police, state regulatory authorities, and the home phone numbers of all site employees.

B. Be clearly communicated to and understood by all site workers and supervisors.

C. Define notification procedures for contacting supervisors, family, and regulatory agencies based on the nature of an incident or accident.

D. For each work site, all workers at the site should know the location of first aid kits and the identity of trained first aid providers.

## 13. BLAST REPORTS

Individual blast reports should be prepared for each blast. Blast reports should include the following:

A. Blast date, time, and location.

B. Weather and environmental conditions like wind speed and direction, current speed (if underwater) and cloud cover, etc.

C. Blast geometry: hole size(s), hole depths, drill pattern, number of holes, bench height, and sub-drilling.

D. Blasthole loading summaries: typical hole loads, explosive types, primers, detonator delays, stemming type and quantity, and total explosive consumption by product.

E. Shot volume and powder factor calculations.

F. Initiation timing scheme: in-hole delays, surface delays, and planned hole firing times.

G. Blast effect monitoring data (if applicable): ground vibration levels and air over-pressures.

H. Notes about blast results, unusual conditions, occurrences, or special precautions.

I. Name and signature of the blaster-in-charge.

## VIBRATION PREDICTIONS

Project: Blue Canyon

K= 300 Charge: 115 lb
m= -1.6

| Distance Distance (ft) | ppv ppv in/s | Distance Distance (ft) | ppv ppv in/s | Distance Distance (ft) | ppv ppv in/s |
|---|---|---|---|---|---|
| 300 | 1.45 | 570 | 0.52 | 840 | 0.28 |
| 310 | 1.38 | 580 | 0.51 | 850 | 0.27 |
| 320 | 1.31 | 590 | 0.49 | 860 | 0.27 |
| 330 | 1.25 | 600 | 0.48 | 870 | 0.26 |
| 340 | 1.19 | 610 | 0.47 | 880 | 0.26 |
| 350 | 1.14 | 620 | 0.45 | 890 | 0.26 |
| 360 | 1.09 | 630 | 0.44 | 900 | 0.25 |
| 370 | 1.04 | 640 | 0.43 | 910 | 0.25 |
| 380 | 1.00 | 650 | 0.42 | 920 | 0.24 |
| 390 | 0.95 | 660 | 0.41 | 930 | 0.24 |
| 400 | 0.92 | 670 | 0.40 | 940 | 0.23 |
| 410 | 0.88 | 680 | 0.39 | 950 | 0.23 |
| 420 | 0.85 | 690 | 0.38 | 960 | 0.23 |
| 430 | 0.82 | 700 | 0.37 | 970 | 0.22 |
| 440 | 0.79 | 710 | 0.37 | 980 | 0.22 |
| 450 | 0.76 | 720 | 0.36 | 990 | 0.22 |
| 460 | 0.73 | 730 | 0.35 | 1000 | 0.21 |
| 470 | 0.71 | 740 | 0.34 | 1010 | 0.21 |
| 480 | 0.69 | 750 | 0.34 | 1020 | 0.21 |
| 490 | 0.66 | 760 | 0.33 | 1030 | 0.20 |
| 500 | 0.64 | 770 | 0.32 | 1040 | 0.20 |
| 510 | 0.62 | 780 | 0.32 | 1050 | 0.20 |
| 520 | 0.60 | 790 | 0.31 | 1060 | 0.19 |
| 530 | 0.58 | 800 | 0.30 | 1070 | 0.19 |
| 540 | 0.57 | 810 | 0.30 | 1080 | 0.19 |
| 550 | 0.55 | 820 | 0.29 | 1090 | 0.18 |
| 560 | 0.54 | 830 | 0.29 | 1100 | 0.18 |

K= 300 Charge: 115 lb
m= -1.6

| Distance Distance (ft) | ppv ppv in/s | Distance Distance (ft) | ppv ppv in/s | Distance Distance (ft) | ppv ppv in/s |
|---|---|---|---|---|---|
| 1110 | 0.18 | 1380 | 0.13 | 1650 | 0.09 |
| 1120 | 0.18 | 1390 | 0.12 | 1660 | 0.09 |
| 1130 | 0.17 | 1400 | 0.12 | 1670 | 0.09 |
| 1140 | 0.17 | 1410 | 0.12 | 1680 | 0.09 |
| 1150 | 0.17 | 1420 | 0.12 | 1690 | 0.09 |
| 1160 | 0.17 | 1430 | 0.12 | 1700 | 0.09 |
| 1170 | 0.16 | 1440 | 0.12 | 1710 | 0.09 |
| 1180 | 0.16 | 1450 | 0.12 | 1720 | 0.09 |
| 1190 | 0.16 | 1460 | 0.12 | 1730 | 0.09 |
| 1200 | 0.16 | 1470 | 0.11 | 1740 | 0.09 |
| 1210 | 0.16 | 1480 | 0.11 | 1750 | 0.09 |
| 1220 | 0.15 | 1490 | 0.11 | 1760 | 0.09 |
| 1230 | 0.15 | 1500 | 0.11 | 1770 | 0.08 |
| 1240 | 0.15 | 1510 | 0.11 | 1780 | 0.08 |
| 1250 | 0.15 | 1520 | 0.11 | 1790 | 0.08 |
| 1260 | 0.15 | 1530 | 0.11 | 1800 | 0.08 |
| 1270 | 0.14 | 1540 | 0.11 | 1810 | 0.08 |
| 1280 | 0.14 | 1550 | 0.10 | 1820 | 0.08 |
| 1290 | 0.14 | 1560 | 0.10 | 1830 | 0.08 |
| 1300 | 0.14 | 1570 | 0.10 | 1840 | 0.08 |
| 1310 | 0.14 | 1580 | 0.10 | 1850 | 0.08 |
| 1320 | 0.14 | 1590 | 0.10 | 1860 | 0.08 |
| 1330 | 0.13 | 1600 | 0.10 | 1870 | 0.08 |
| 1340 | 0.13 | 1610 | 0.10 | 1880 | 0.08 |
| 1350 | 0.13 | 1620 | 0.10 | 1890 | 0.08 |
| 1360 | 0.13 | 1630 | 0.10 | 1900 | 0.08 |
| 1370 | 0.13 | 1640 | 0.10 | 1910 | 0.08 |