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- To reduce complications reading, I've simplified the recipe book to two sections: Basic carbons to Semi/Stainless and CPMs and thusly organized by general mechanics.
- For rapid acquisition, use the MSWord Find option to readily reach specific steel types.
- This is a direct lift from the NJSB document so please pardon redundancy and remedial information copied over.
- In many instances staple Euro steels translate well to coordinating AISI equivalents; for example Silver Steel readily adapts to the HT schedule for AISI 1095 and W1, and C75 or nickel alloyed derivatives readily heat treat using schedules for AISI 1075 or 15n20.
- For heat treating composite pattern welds, target equivalent shared carbon content; for example, 15n20 and 1084 although the nickel in 15n20 prevents carbon migration, we readily should see shared carbon content between the 15n20's .75%C and the 1084's .84% as equating to best suited following the HT schedule for 1080.
- In laminate/clad steels (e.g. san or go mai), heat treat schedules should focus on core material (thusly a 416 clad 52100 blade should follow the HT schedule for 52100) and be given a "snap" 1hr temper to avoid delamination or critical failure if one cannot immediately perform a full double 2hr temper cycle after quenching.

<u>Basic High Carbons and Simple High Carbon Tool Steels</u>: Listing ascends C% to alloying complexity/sensitivity to heat treat.

1075:

<u>Normalization</u>:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:

ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.

Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.

Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.

*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.

**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,480°F / 801°C	5-15 minutes	64-65

Tempering:

Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.

Figures supplied are as representative of industrial standards.

*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.

Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.

Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

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1080 Square Bar:

Normalization:
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Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle)	(2nd cycle)	(3rd cycle)
1,650°F / 898°C (10-15 min)	1,500°F / 815°C (10-15 min)	1,350°F / 732°C (10-15min)

Hardening:
ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
****Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,480°F / 801°C	5-15 minutes	64-65

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

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Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

1084:

Normalization:

Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.

Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.

Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:

ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.

Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.

Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.

*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.

**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,480°F / 801°C	5-15 minutes	64-65

Tempering:

Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.

Figures supplied are as representative of industrial standards.

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*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

1095:

Normalization:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:
ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.

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**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,475°F / 801°C	5-15 minutes	64-65

Tempering:

Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.

Figures supplied are as representative of industrial standards.

*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.

Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.

Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

15n20:

Normalization:

Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.

Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.

Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle)	(2nd cycle)	(3rd cycle)
1,650°F / 898°C (10-15 min)	1,500°F / 815°C (10-15 min)	1,350°F / 732°C (10-15min)

Hardening:

ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to

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reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,480°F / 801°C	5-15 minutes	64-65

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

5160:

Normalization:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.

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Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:

ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.

Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.

Suggested quench oil: Parks AAA, Mcmaster 11-second, Houghton G--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.

Parks 50 can be used, but may result in less toughness without thorough tempering.

*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.

**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,465 to 1480°F / 801°C	5-15 minutes	63-62

Tempering:

Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.

Figures supplied are as representative of industrial standards.

*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.

Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.

Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	63
350°F / 177°C	62-61
400°F / 204°C	60-59
450°F / 232°C	57-58
500°F / 260°C	55-56

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550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

52100:

Normalization:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:
ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks AAA, Mcmaster 11-second, Houghton G--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
Parks 50 can be used, but may result in less toughness without thorough tempering.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,465 to 1480°F / 801°C	5-15 minutes	64-65

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of

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conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

80CrV2:

Normalization:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle)	(2nd cycle)	(3rd cycle)
1,650°F / 898°C (10-15 min)	1,500°F / 815°C (10-15 min)	1,350°F / 732°C (10-15min)

Hardening:
ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks AAA, Mcmaster 11-second, Houghton G--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
Parks 50 can be used, but may result in less toughness without thorough tempering.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,465 to 1480°F / 801°C	5-15 minutes	64-65

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Tempering:

Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.

Figures supplied are as representative of industrial standards.

*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.

Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.

Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

L6:

Normalization:

Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.

Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.

Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:

ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.

Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.

Suggested quench oil: Parks AAA, Mcmaster 11-second, Houghton G--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.

Parks 50 can be used, but may result in less toughness without thorough tempering.

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*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
****Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,465 to 1480°F / 801°C	5-15 minutes	63-62

<u>Tempering</u>:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	63
350°F / 177°C	62-61
400°F / 204°C	60-59
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

O-1:

<u>Normalization</u>:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

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Hardening:

ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks AAA, Mcmaster 11-second, Houghton G--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
-Parks 50 is not recommended.
***Austenizing soak time for O1 is a crucial factor and not recommended for forge heat treating without PID or similar calibrated equipment for holding austenizing temperature accurately.**
****Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,465 to 1480°F / 801°C	20-30 minutes	64-65

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

W1:

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Normalization:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:
ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,475°F / 801°C	5-15 minutes	64-65

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65

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350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

W2:

Normalization:
Normalization is a process intended to refine grain and stress relieve blades prior to hardening when needed.
Turco, ATP-641, foil, or similar may be used to reduce surface decarburization and scaling.
Time at temperature suggested for varying thicknesses. Once knife has cooled to black and magnetic, it can be cycled again--be careful handling hot blades.

(1st cycle) 1,650°F / 898°C (10-15 min)	(2nd cycle) 1,500°F / 815°C (10-15 min)	(3rd cycle) 1,350°F / 732°C (10-15min)

Hardening:
ATP-641, Turco, or similar high temperature anti-scale/decarburization coatings can be used to reduce scale or surface decarburization.
Data is representative of controlled heat treating equipment (e.g. oven, salts, etc.) temperatures and industrial standard quenchant.
Suggested quench oil: Parks 50--expected as quenched hardness may be lower if a slower quench oil or non-industrial quench medium is used.
*Austenizing soak time varies 5 to 15 minutes based on heat treating equipment and cross section--soak times are reduced to minimum for people heat treating in a forge--forge heat treating without PID temperature control limits accurate means of maintaining temperature. If using calibrated, proper industrial equipment for heat treating, use the supplied extended soak times based on over all steel thickness.
**Do not put blades in oven when cold, insert at or just below austenizing temperature--temperature variances is for difference in stock thicknesses and a window of margin for error.

Austenizing temperature	Hold/Soak Time	Expected Rc (as quenched)
1,450 to 1,475°F / 801°C	5-15 minutes	64-65

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain

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temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	65
350°F / 177°C	63-64
400°F / 204°C	60-61
450°F / 232°C	57-58
500°F / 260°C	55-56
550°F / 288°C	53-54
600°F / 316°C	52-53
650°F / 343°C	50

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<u>Air Quenching Steels</u>: *Stainless, semi-stainless tool steels, and CPMs (non-particular order as grafted from parent document)*

A2:

<u>Hardening</u> :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,450°F / 787°C (hold 15 minutes)	1,750°F / 954°C Soak 30 minutes	63Rc (64 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 1 to 4 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed with a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods

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and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	64
350°F / 177°C	63
400°F / 204°C	62
450°F / 232°C	61
500°F / 260°C	60
600°F / 316°C	58

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

D-2: (standard, not to be confused with CPM D2)

Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
*****Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*****Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-heat/Equalizing	Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,200°F / 650°C (hold 10-15 minutes)	1,400°F / 760°C (hold 10-15 minutes)	1,850°F / 1065°C Soak 30 minutes	61Rc (64 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 1 to 4 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

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Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	62
400°F / 204°C	61
500°F / 260°C	60
600°F / 316°C	59

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

154-CM:

Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into a high temperature foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering is recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,400°F / 760°C (hold 15 minutes)	1,950°F / 1065°C Soak 30 minutes	61Rc (63 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.

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While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 4 to 8 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	63
400°F / 204°C	62
600°F / 316°C	60

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

440C:

<u>Hardening</u> :

****Knives should be cleaned by washing with soapy water and then either placed into a foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

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Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,425°F / 760°C (hold 15 minutes)	1,875°F / 1038°C Soak 30 minutes	59Rc (61 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 4 to 6 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp-- cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	60
400°F / 204°C	59
500°F / 260°C	57
600°F / 316°C	56

**manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

AEB-L:

<u>Hardening</u> :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.

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*******Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
********Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,500°F / 815°C (hold 15 minutes)	1,950°F / 1065°C Soak 15 minutes	60Rc (63 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 30 minutes to 1 hour depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp-- cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	63-62
350°F / 177°C	62-61
400°F / 204°C	61-60
450°F / 232°C	59-58
500°F / 260°C	58-57

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**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

CPM 154CM

Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,400°F / 760°C (hold 15 minutes)	1,950°F / 1065°C Soak 30 minutes	61Rc (63 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 4 to 8 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester,

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can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	63
400°F / 204°C	62
600°F / 316°C	60

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

CPM D2:

Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-heat/Equalizing	Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,200°F / 650°C (hold 10-15 minutes)	1,400°F / 760°C (hold 10-15 minutes)	1,850°F / 1065°C Soak 30 minutes	61Rc (63 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 1 hour depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

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Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	62
400°F / 204°C	61
500°F / 260°C	60
600°F / 316°C	59

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

CPM S30V

Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,550°F / 845°C (hold 10-15 minutes)	1,950°F / 1065°C Soak 15-30 minutes	62Rc (63 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done

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before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 1 to 4 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp-cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	62
400°F / 204°C	61
600°F / 316°C	59

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

CPM S35-VN

<u>Hardening</u> :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

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Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,550°F / 845°C (hold 10-15 minutes)	1,950°F / 1065°C Soak 15-30 minutes	62Rc (63 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 1 to 4 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	62
400°F / 204°C	61
600°F / 316°C	59

**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

Nitro-V
Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as

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possible) between preheating and austenizing temps.
********Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,500°F / 815°C (hold 15 minutes)	1,950°F / 1065°C Soak 15 minutes	63Rc (64 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 1 hour depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
300°F / 149°C	64
350°F / 177°C	63
400°F / 204°C	62
450°F / 232°C	61
500°F / 260°C	60
600°F / 316°C	58

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**Manufacturers warn against tempering at 800°F / 425°C and above as sensitization will result in reduction of toughness and corrosion resistance.

CPM 3-V:

Hardening :

****Knives should be cleaned by washing with soapy water and then either placed into foil pouch or coated with high temperature anti-scale/decarburization compound prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent under quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,550°F / 845°C (hold 10-15 minutes)	1,950°F / 1065°C Soak 30 minutes	60Rc (62 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
Liquid Nitrogen is recommended for the needed -280°F / -137°C
Submerge in sub-zero treatment 10 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper three times for 2 hours each.

Temperature:	Hardness (2 hour x2 guideline):

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975°F / 523°C	61
1000°F / 537°C	60-59

CPM M4:

Hardening :

****Knives should be cleaned by washing with soapy water and then placed into high temperature tool wrap foil (2,200°F+ rated) pouch prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent under quenching under positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-heat/Equalizing	Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,500°F / 815°C (hold 5 minutes)	1,800°F / 982°C (hold 5 minutes)	2,100°F / 1,175°C Soak 15 minutes	64Rc (65 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
While liquid nitrogen is preferred, a sub zero bath with dry ice and kerosene will suffice for -100°F / -74°C.
Submerge in sub-zero treatment 4-6 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper three times for 2hrs.

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Temperature:	Hardness (2 hour x3 guideline):
1,000°F / 537°C	64
1,025°F / 551°C	63
1,050°F / 565°C	62
1,100°F / 593°C	60

CPM S90V:

Hardening :

****Knives should be cleaned by washing with soapy water and then placed into high temperature tool wrap foil (2,200°F+ rated)pouch prior to heat treat if not using Oxygen free heat treat equipment.
*****Skipping stages such as pre-heating and equalizing or cryo will result in lower hardness, higher amounts of Retained Austenite (RA), impaired stain resistance or other issues. Ramp AFAP (as fast as possible) between preheating and austenizing temps.
******Clamping flat after quench during cryo or tempering recommended to avoid thermal shock induced warp.
*******Figures represent under quenching positive pressure with aluminum plates and compressed air to at or below 125°F / 50°C**--alternative quenching methods may present lower hardness, high RA, or other issues.

Pre-Heat/Equalizing	Austenizing temperature	Expected Rc (as quenched prior to cryo)
1,450°F / 787°C (hold 10 minutes)	2,100°F /1150°C Soak 20 minutes	60Rc (61 after Cryo)

Cryogenic Treatment:
A cryogenic treatment is recommended to convert retained austenite, and can either be done before or after the first temper cycle.
Liquid nitrogen is recommended, dry ice/kerosene may be substituted--Current available Crucible spec sheet does not include specific sub-zero range.
Submerge in sub-zero treatment 6-8 hours depending on thickness and number of blades.

**A cryogenic treatment can be done immediately done after quench, but it is recommended blades be clamped flat to avoid thermal shock induced warp--cryo treatment should always be followed by a tempering cycle.

Tempering:
Once blade is quenched and near ambient temperature, blades should be tempered accordingly, the times suggested are to ensure even, consistent temperature.
Figures supplied are as representative of industrial standards.
*If using a small toaster oven or household kitchen oven for tempering, using a blade holding rack made from kiln furniture, a roasting tray lined with fine sand, or similar large object will help retain thermal mass to reduce wide swinging temperatures as the device fluctuates trying to maintain temperature.

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Note: Final hardness values vary based on initial as-quenched hardness and percentage of conversion to Martensite. Only reliable testing methods, e.g. calibrated Rockwell hardness tester, can provide actual hardness values--hardness calibrated files and chisels are relative testing methods and inaccurate for true hardness value reading.
Temper twice for 2hrs.

Temperature:	Hardness (2 hour x2 guideline):
400°F / 204°C	60-61

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